GROWTH AND ADJUSTMENT

OF THE

LOS ANGELES

MILKSHED

A Study in the Economics of Location

L. B. FLETCHER and C. O. McCORKLE, JR.

T HIS BULLETIN examines the demand and supply conditions for fluid milk
in California and Los Angeles County. It describes the structural character-
istics of the Los Angeles milk market, and analyzes production and transpor-
tation costs in various present and potential supply areas. It analyzes producer
prices, procurement practices, and location adjustments that have been made,
and discusses supply adjustments likely to be made in the future.

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THE FINDINGS

THIS BULLETIN REPORTS studies in the economics of location of the dairy industry in the Los Angeles milkshed. Traditionally, the major locational advantage in the production of fluid milk has been nearness to market. This study shows, however, that an industry may tend to remain where it was started even if the original reasons for starting in this particular location have disappeared.

Nearness to market, plenty of locally produced feed, and climate gave an early advantage to dairymen in Los Angeles County. After World War II the industry expanded because market demand increased as a result of rapid population growth and urbanization in southern California. Urbanization also put economic pressures on dairymen—in the form of rising land values and taxes, higher wage rates, and increasing feed costs (as bulky hay had to be brought into the area). By developing large, specialized, factory-type operations—permitting intensive use of capital equipment, high labor efficiency, and maximum production per cow—dairymen in Los Angeles County kept their production costs competitive with other areas, and produced a stable, high-quality supply of milk at low procurement costs for distributors.

When market requirements for Los Angeles plants increased during the Korean War, dairymen in the San Joaquin Valley stepped up their share, and a new market structure emerged. It was based on the use of milk from the southern milkshed for Class 1 purposes, on weekly and seasonal supplemental milk and cream shipments from the outlying northern region, and on keeping surplus production in the outlying area for use in manufactured products. Such a use pattern is remarkably consistent with a theoretical organization that would result in low aggregate transport costs in the market. Therefore, the dairy industry in the Los Angeles milkshed was found to be efficient in using the resources presently committed to milk production.

Comparisons of unit costs for comparable synthesized operations in the competing supply regions showed that production cost differentials in the northern region more than offset added transport costs. This means that, for efficient long-term growth in industry output, the share of raw-product supply for Los Angeles plants from northern producers should be increased relative to production in the southern milkshed.

Interregional prices to dairymen following existing market supply patterns (as determined in a complex framework of minimum class prices established f.o.b. plant, individual plant pools, and producer contracts) differed by more than the higher transportation costs from the farther northern milkshed to Los Angeles plants. These differentials were sufficient

to overcome production cost differentials and make production more profitable for southern dairymen. This situation restricts the mobility of the dairymen; it encourages them to remain in high-cost areas or to move to locations where revenue conditions are unchanged. Therefore, manipulation of the pricing system to increase and stabilize average returns to dairymen has distorted its function in resource allocation.

What is needed most to correct the misallocation of resources is to modify the pricing structure in a way to provide incentives for distributors to procure larger quantities of milk from the lower-cost area, without destroying current incentives to use this milk efficiently. Northern dairymen have been unable to use their lower costs as a competitive advantage to obtain a larger share of the market. This demonstrates the "toughness" of a marketing system that has grown up over a period of years in a framework of administrative pricing, and in which large vested interests have accumulated.

These distorted interregional price relationships, so harmful to the efficient long-term growth of industry output because of their relationships to the allocation of resources in the industry, do not exist because responsible public agencies want these distortions nor because their remedies are unknown. They exist largely because the pricing arrangements and use patterns that caused them are deeply imbedded in the historical and institutional relationships of the market in the Los Angeles milkshed.

I. SETTING AND SCOPE OF THE STUDY

DEMAND AND SUPPLY CONDITIONS FOR FLUID MILK

RECENT STUDIES have analyzed state and national economic trends affecting the future of the California dairy industry. Simmons (1959) estimated that per capita consumption of dairy products in California in 1955 exceeded per capita production by 177 pounds. He projects a 66 per cent increase in the 1955 deficit by 1975, to 292 pounds. Production in the state is expected to increase only sufficiently to meet consumption requirements for fluid milk, fluid cream, and ice cream, which are projected to total 12.6 billion pounds by 1975—62 per cent above the 1959 production of 7.8 billion pounds of milk. Deficit requirements will be met by increased inshipment of manufactured products from surplus-producing areas.

If it is assumed that average production per cow will rise to 10,400 pounds per year, 1,209,900 cows would be required to achieve projected production levels by 1975. That represents an increase of about 365,000 cows above the 945,000 reported for the state in 1958. (California Crop and Livestock Reporting Service, A1958, p. 9). Dean and McCorkle (1960) concluded that the productive resources available to California dairymen should be sufficient to permit this build-up in dairy herds.

Los Angeles County provides a dramatic example of the impact of rapid population growth and economic development on the dairy industry. Population exceeded 6 million in 1960, more than twice that of 1940, and growth is similar in surrounding counties. There is every reason to believe that Los Angeles and

adjacent counties will continue to share more than proportionately in California's future population growth (Calif. Department of Finance, 1959; Los Angeles Chamber of Commerce, 1959). A recent study (Southern California Research Council, 1960) envisions a "Southern California Metropolis,"—a giant, sprawling metropolis extending along the Pacific Ocean from Santa Barbara to San Diego and inland beyond San Bernardino and Riverside, into the desert. The population of this metropolis is expected to approximate 15 million by 1975, two-thirds more than the 9 million in 1960. Los Angeles County alone is expected to have a population of 9 million in 1975.

What adjustments can be expected in sources of supply of dairy products in Los Angeles County (which, unlike the state as a whole, is deficit in the production of fluid milk as well as of milk for other uses)? In 1959, consumption of fluid milk in the county was about 2 billion pounds, production slightly more than 1.3 billion pounds. The requirement anticipated by 1975 will exceed 3.5 billion pounds (based on a population of 9 million).

Milk production has also been greatly affected by the industrial and commercial activity in the county. Dairies have been squeezed into smaller and smaller areas. Producers have responded to economic pressures by moving outside the county or by developing an intensive type of production with larger herds on relatively little land. These adjustments, together with higher levels of production per cow, have permitted successively fewer dairies to produce more milk each year.

At present, Los Angeles County is the leading county in the nation in terms of number of milk cows on farms, amount of milk sold, and value of milk production. However, further population increase in the remaining milk-producing areas in the county may force dairy farms out completely. Thus, substantial adjustments are likely in sources of supply of fluid milk for the Los Angeles market.

PURPOSES OF THIS STUDY

This is the broad context of economic change within which this study was undertaken. Specific objectives include:
- A description of the structural characteristics of the Los Angeles milk market and supply area;
- Identification and empirical analysis of what determines geographic patterns of production, utilization, and prices of fluid milk in the milkshed; and
- Prediction of future adjustments in sources of supply for the Los Angeles market.

The study touches areas of both private and public concern. Locational choices are important in the long-run commitment of individual resources to, and adjustments in, agricultural production. But the locational choices of individual firms and public policies affecting market supply patterns must be based on an understanding of the basic economic forces that underlie industry production, utilization, and price relationships. This study attempts to provide a basis for understanding and evaluating factors influencing firm and regional adjustments in the Los Angeles milkshed.

The findings are used to analyze the following types of questions: What factors determine the *direction* and *rate* of adjustments in sources of supply for this market? What factors lag behind others in the process of locational adjustment? To what extent is it possible, through modification of the institutional organization of the market, to stimulate spatial mobility of resources that will increase the economic efficiency of the industry?

SCOPE OF THE ANALYSIS

This study focuses on the sources of supply for firms with milk plants in Los Angeles County. In June, 1959, more than 99 per cent of total sales of 15.2 million gallons of fluid milk in the Los Angeles County Marketing Area was made by

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plants located in the county[2] (California Crop and Livestock Reporting Service, D1959, p. 10). In addition, Los Angeles plants sold directly to customers located in other marketing areas more than 2.5 million gallons of milk. Taken together, total sales of fluid milk by Los Angeles plants were nearly 18 million gallons, representing about 75 per cent of fluid milk sales in all of southern California, and about 45 per cent of sales in the state as a whole.

Direct selling includes shipment and sale of processed and packaged milk by plants in Los Angeles County to customers in other marketing areas. In June, 1959, sales in other areas were about 17 per cent as large as those in Los Angeles Marketing Area. In that month direct shipments were made to nine other marketing areas, as follows:

MARKETING AREA	PER CENT OF TOTAL SALES OF FLUID MILK IN THE RECEIVER'S AREA
Ventura	57
Orange	34
San Bernardino-Riverside	31
San Diego	29
Santa Barbara	17
Inyo-Mono	11
Kern	10
Imperial	8
San Luis Obispo	5

For comparison, in February 1954, direct sales of Los Angeles plants to other areas were only about 10 per cent as large as in the Los Angeles Marketing Area (Clarke, 1955, pp. 164–79).

In addition to direct shipments to other

[2] Prior to August, 1959, the Los Angeles County Marketing Area included all of Los Angeles County except a strip at the southeastern corner. In that month, this marketing area and the ones adjacent were modified. The section of Los Angeles County north of the San Gabriel Mountains was incorporated into the San Bernardino-Riverside Marketing Area, as was the southern portion of Orange County. The remaining portions of Los Angeles and Orange counties were designated as the Los Angeles Marketing Area.

areas, fluid milk is shipped between plants in different areas. Such interplant transfers may be bulk shipments of unprocessed milk and cream as well as processed milk and milk products. The former are an important element in the raw-product procurement of distributing firms. The latter were only 2 per cent as large as sales in the Los Angeles area in 1954 (Clarke, 1955).

The substantial and increasing movement of fluid milk to other areas, as shown by the increase in direct sales by Los Angeles plants, has implications for the study of "milk markets" in California. It demonstrates the growing tendency of most large milk markets, including their supply areas, to become larger and more integrated. As urban areas expand, producers and distributors adopt technical advances in handling and processing milk, the pattern of small milksheds around each market tends to disappear. Continuous expansion in consumption, due largely to increased size and population of market areas, has resulted in enlarged milksheds, with milk from large surplus areas moving into several consuming centers.

The San Joaquin Valley, for example, has become a source from which milk is drawn by the major consuming areas to the north and south. Intermarket and inter-area integration of assembly, processing, and distribution facilities has in some cases proceeded so far that only a few large markets are now distinguishable in the state.

THE ECONOMIC MODEL

The ultimate objective of this study is to predict future area adjustments in supply patterns, against a background of rapidly increasing market requirements. In broad terms, what is needed for this study is a theoretical framework appropriate for analysis of adjustments, through time, in geographic production and utilization patterns of fluid milk for

a large market.[3] First, past and present changes reflecting investment and operating decisions at the firm level must be explained. At the same time, the theoretical framework should provide *a priori* hypotheses about the economic relationships at the industry level. Theoretical conclusions as to economically efficient industry supply and utilization patterns may be established as norms against which actual performance can be measured. If deviations from theoretical optima are substantial, factors encouraging or inhibiting desirable shifts can be examined, and policy implications drawn.

A distinctive feature of fluid milk production in the Los Angeles supply area is the presence of large, specialized firms utilizing corral feeding of cows with purchased feeds. This dry-lot production organization, common in the southern portion of the milkshed, is being rapidly adopted by producers in its northern segment. Under these conditions, the production unit may be thought of as a processing facility for conversion of raw materials into milk—a virtual milk factory. The major raw material is feed. If the dairyman specializes completely in milk production, and depends on feed supplies purchased off the farm, then he is faced with the locational problem of where to operate—at the source of feed supplies, at the market, or at some intermediate point.

Further, the land requirements of this type of milk production are relatively small. Once a minimum acreage is obtained, rate of output can vary greatly through intensive adjustments requiring no increase in land area. Since land outlays may be less critical in drylot milk production than in other types of agricultural production, it becomes correspondingly more important to investigate outlays on other factors. Labor, the other

major cash expense, is of major concern in establishing locational advantages. Capital costs, taxes, and economies and diseconomies of industry concentration are cost factors that are important elements affecting locational choices of producers.

The demand factor is also important in this study. Minimum class prices for fluid milk are determined administratively by a state agency, but net producer prices are affected by other factors, including an inter-firm contractual arrangement between producers and distributors. Individual producer prices are not independent of quantity sold. Producer-level demand enters the analysis of locational choices as a relevant variable. Optimum locational choices for a firm must be approached from the viewpoint of *maximum profit* in which locational choices as well as levels of output reflect attempts by producers to obtain the widest spread between total revenues and costs.

The best location is not necessarily that where a firm can produce a product at lowest unit costs, including transport to the market. If the seller faces different demands or different prices at different locations, then a given location may offer the greatest profit potential, even if costs at that location are higher than those elsewhere. Thus, demand at alternative locations becomes a variable to be analyzed along with cost factors in a model adequate to explain optimum firm locational choices.

At the aggregative level the concept of spatial equilibrium links firm locational choices to geographic production and utilization patterns of the industry. The latter involves determination of the quantities traded and the price relationships of a homogeneous commodity between surplus and deficit regions that are separated—though not isolated—by a transport cost per unit of product shipped, under conditions of pure competition.

A spatial equilibrium model and solu-

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[3] For a review of alternative approaches to the theory of location and a more detailed discussion of the theoretical model used in this bulletin, see Fletcher (1960).

tion for the single-product, two-region case is illustrated in figure 1. Here, the supply and demand curves for Region I are plotted in conventional form on the right half of the diagram, but the supply and demand curves for Region II are reversed on the left half. Thus, quantities are measured to the right of the origin for Region I, but to the left of the origin for Region II, and the quantity axis of Region II has been elevated to a position above that of Region I by an amount equal to the unit transfer cost between the two regions, t_{12}. Prices in the two regions are measured on the common ordinate from the appropriate origin, O' for Region II, O for Region I. In the absence of trade between the two regions, equilibrium prices and quantities in the two regions would be determined by intersection of the regional demand and supply curves. If these prices differ by more than transfer costs, i.e., they are not on a horizontal line on the back-to-back diagram, trade between the two regions would be profitable. Excess supply functions, which show the amounts by which the quantities offered in each region would exceed the quantities demanded at various prices, can be constructed for each region. These are illustrated by curves ES_I and ES_{II}, and their intersection defines the equilibrium prices with trade (OP*, O'P*), which differ between the regions by the unit transfer costs. The distance, O'B, shows the quantity traded, and this is equal to the quantity shipped by Region II (CD) and received by Region I (EF).

Interregional price differentials that correspond exactly to the costs of transporting the product between the two regions are termed "efficient." In this study, where shifting market supply patterns are the focus, the degree to which prices in the competing supply regions
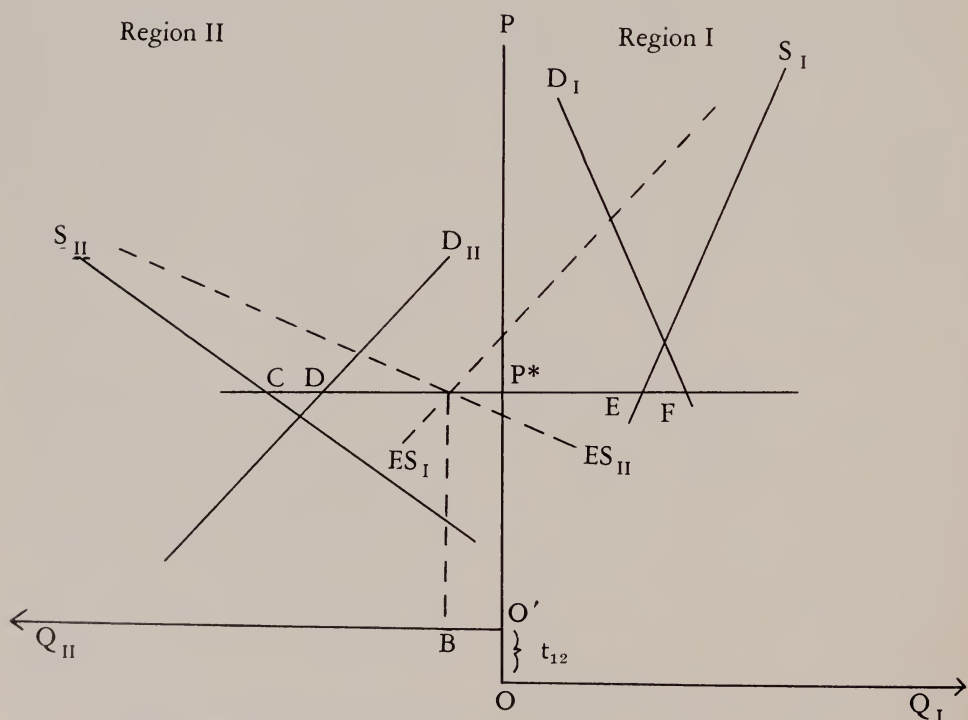
Figure 1. Spatial equilibrium for the single-commodity two-region case.

reflect differences in transport costs is of interest primarily because of its relation to regional allocation of resources in producing the product. When such prices prevail and regional supply curves are theoretically obtained by horizontal summation of the marginal cost curves for all producers in the region, the marginal costs *at the deficit market* of the last unit obtained from each supply region are equal to each other and to the equilibrium price of the product. Hence, the marginal cost of the last unit produced in the deficit region equals marginal cost of production in the surplus region plus transfer costs.

This allocation of production between regions will minimize the *sum* of production and transport costs for the total amount produced and used in the two areas; it is impossible to reduce the combined costs of production and transport of total supply by adjusting regional production or the amount transferred between regions.

In addition, when factor as well as product markets are assumed to be perfect, the values of the marginal products of factors employed in the competing supply regions will be equated to the price of the factors in each region. Assuming equal productivity of a factor between regions, the regional price of the product then becomes the principal determinant of the extent to which milk producers can compete for the services of the factor against the competition of alternative uses, as represented by factor opportunity costs.

Thus, this expanded model permits a more explicit statement of the efficiency norm adopted earlier. If the setting of the problem is assumed to be a purely competitive one, in the sense that no individual firm or owner of resources can affect the market in which he is dealing, certain conclusions can be reached with respect to optimum choice of production location and spatial allocation of resources. Optimum choice in this sense implies regional levels of production and interregional movements of the product that minimize the combined costs of producing and transporting the total quantity produced and consumed.

This study treats the problem of interregional competition involving shifting regional supply relationships.[4] Changes in basic determinants underlying regional supply, such as number and size of firms, are the critical elements in this analysis. In this sense, this is a study of long-run adjustment rather than of short-run regional supply relations involving given producing units with fixed locations. The problem is generally one of assuming future levels of demand in the market area and, in light of this assumption, analyzing the factors affecting adjustments in locational patterns of production and utilization. The nature of the competitive advantages in major competing regions, factors likely to change competitive relations in the future, and implications for supplies to be forthcoming in the competing producing areas, will each be studied. Moreover, any model designed to analyze long-run adjustments in milk supply must incorporate or, at least, recognize the presence of institutional pricing arrangements and of buying firms and groups of sellers with sufficient market power to influence regional demand or supply relations.

The model does provide a convenient division of major factors contributing to locational adjustments in the Los Angeles supply area into two groups: those affecting supply or costs, and those affecting demand or revenues. Factors determining relative regional production costs are investigated in Section III, since they are basic determinants of the quantity of milk that producers are willing to supply at given prices, and since they serve as criteria for projecting opti-

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[4] For a thorough review of the alternative approaches and difficulties encountered in agricultural supply analysis, see Nerlove and Bachman (1960, pp. 531–554).

mum supply adjustments. The process by which producer returns are determined in the competing supply areas is investigated in Section IV. Future adjustments are then predicted based on alternative assumptions about cost and revenue variables. Finally, modifications in institutional pricing arrangements that would encourage adjustments toward an economic optimum are explored (Section V).

SOURCES OF DATA

In addition to data published by the California Crop and Livestock Reporting Service, a large body of primary data was provided by the Bureau of Milk Stabilization, California Department of Agriculture. Data obtained related to plant procurement of raw product, utilization, and payments to producers, and provided the basis for describing the market structure and analyzing procurement and utilization patterns in the milkshed. These reports were surveyed for six selected months spanning a three-year period. In light of seasonal patterns in plant receipts and utilization, a spring and a fall month, June and October, were selected for each year.

Data on geographic location, production, and disposition of milk by dairies in their inspection areas were provided by dairy inspection agencies of the Los Angeles City, Los Angeles County, Orange County, San Bernardino County, and Riverside County Health Departments. In addition, supplementary information was provided on milk plants operated by producer-distributors, who are not required to submit monthly reports to California's Bureau of Milk Stabilization.

Highly useful data were also obtained by interviews with numerous persons involved in verious phases of the dairy industry. These included executives of Los Angeles milk distributing firms, the planning commissions of Los Angeles, Orange, and San Bernardino counties, city officials of the incorporated dairy areas, and officials of producer cooperative groups and bargaining associations.

All data on production organization and equipment, input-output relationships, investments, and factor prices used in this bulletin to derive relative production costs between competing areas of the milkshed, are from Davidson, J. R., 1960.

II. STRUCTURAL CHARACTERISTICS OF THE LOS ANGELES MILK MARKET

THE CHARACTERISTICS OF FLUID MILK marketing that derive from continuous production, perishability, and unsynchronized movements in supply and demand underlie the adoption of many of the structural and institutional elements that have come to typify such markets. This section describes certain structural characteristics of this market as a background for the empirical study of determinants

of geographical production, utilization, and price patterns.

THE CALIFORNIA MILK CONTROL PROGRAM

In the United States, state and federal participation in pricing is more extensive and direct in the marketing of fluid milk than that of any other agricultural commodity, giving to large parts of the fluid

milk industry a quasi public-utility status. California is one of 11 states that regulate milk prices at both producer and resale levels (U. S. Dept. of Agric., 1959).

The first statutory authority for establishing minimum producer prices for milk in a given area in California was contained in the Young Act, 1935. In 1937, the Desmond Act made establishment of minimum resale prices mandatory in all marketing areas in which producers' prices are controlled. The Young and Desmond acts, as modified and revised subsequently, provide the legislative basis for minimum prices to producers, minimum resale prices, and related aspects of marketing of fluid milk in California.[5]

The policy objectives of these acts clearly emphasize concern for the general welfare of the consumer as a basis for invoking the police power of the state, although the principal proponents of the laws were undoubtedly those groups most directly concerned with its operation—the producing and distributing segments of the dairy industry itself. For a detailed analysis of the history of state price control see Tinley (1938) and Clarke (1955).

The objectives of the existing milk control law are:

1. To ensure an adequate and continuous supply of pure fresh wholesome fluid milk and fluid cream to consumers at fair and reasonable prices;
2. To enable the dairy industry with the aid of the state to correct existing evils, and develop and maintain satisfactory marketing conditions;
3. To bring about and maintain a reasonable amount of stability and prosperity in the production and marketing of fluid milk and fluid cream;
4. To provide means for carrying on essential educational activities.

[5] The provisions of these acts are presently contained in Chapter 17, Division 6, of the Agricultural Code of the State of California.

The director of agriculture is given wide discretionary powers in making rules and regulations he considers necessary in enforcing the provisions of this chapter. The legislature has stated, however, that nothing in the chapter of the code containing the milk control law shall be construed as permitting or authorizing the development of conditions of monopoly in the production or distribution of fluid milk or fluid cream. The following discussion focuses on the standards and procedures provided to guide the director in carrying out the objectives of the program.

Producer Pricing

The classified price plan. Classified pricing establishes separate prices for milk going to different ultimate uses in any given market. The Agricultural Code in California provides for milk to be classified into three categories. Class 1 comprises any fluid milk, fluid skim milk, or fluid cream supplied to consumers as market milk, market skim milk, market cream, or concentrated milk, or any combination of these fluid products, and any other dairy product in which the use of market milk is required by the Agricultural Code. Class 2 includes any fluid milk, fluid skim milk, or fluid cream used in the manufacture of a product for which a standard is described in Division 4 of the code and not included in Class 1 and 3. Generally, this category includes manufactured products that are relatively bulky and perishable, principally cottage cheese, frozen dairy products, and buttermilk. Class 3 includes milk, skim milk, or cream used for the manufacture of evaporated milk, butter, cheese, or powder.

Marketing areas. In administering the provisions of the law, the director is empowered to designate marketing areas, employing the standard or uniformity of conditions affecting production, distribution, and sale of fluid milk within the designated area. There are presently 32

marketing areas, including virtually all inhabited parts of California.

Stabilization and marketing plans. These are the basic instruments that the director uses in accomplishing the objectives of the law. If a plan is desired by at least 65 per cent of the producers— by number and by volume of milk produced—the director formulates a plan, subject to industry review before being placed in operation.

For producers, the most critical provisions in the stabilization and marketing plans are those relating to pricing. Each plan is required to establish minimum prices to be paid by distributors to producers for fluid milk by classes. These prices are to be in "reasonable and sound" economic relationship with the price of manufacturing milk. Prices are permitted to vary among areas because of differences in costs of production, health regulations, transport costs, and other factors, but within any marketing area the cost to distributors for fluid milk and fluid cream of similar quality must be uniform.

Additional mandatory provisions relating to producer prices in each plan include:

1. A requirement that distributors shall not purchase more than 200 gallons monthly from any producer without entering into a written contract specifying certain conditions of purchase;
2. A requirement that no distributor pay less than the established minimum producer prices; and
3. Provisions whereby minimum prices will be established and paid for fluid milk that is received by a distributor in one marketing area and transported and used in another marketing area or in a locality for which no plan is in effect.

Optional provisions that may be included in stabilization and marketing plans include:

1. Requirements that a distributor report to each producer from whom he buys milk, the volume of fluid milk received, the milk fat test, amount paid for in the various classes, and the prices paid;
2. Provision for pooling milk that is diverted for manufacturing purposes directly to a manufacturing plant in the area of production; and
3. Provisions for establishing equalization pools for all producers supplying fluid milk to distributors in the marketing area involved, provided 65 per cent of the producers, by number and volume, approve.

No provision in any plan issued under this law is to prevent quality premiums, price differences due to transport differentials, or pooling of proceeds by cooperatives. A specific prohibition is placed on any provision that would limit the production of fluid milk or cream.

Resale Pricing

In addition to minimum producer prices, six types of resale prices are established: a wholesale price for all wholesale sales; a retail store price to consumers; a retail price to consumers for home delivery; a retail price to consumers at the producer's ranch ("cash and carry sales"); a retail price to consumers at the distributor's plant ("dock sales"); and a price for inter-distributor sales of processed and packaged milk including sales to peddlers.

Unfair Trade Practices

When the control legislation was enacted, it was recognized that economic pressures within the industry led to destructive trade practices as well as price wars. For this reason, the act providing for minimum resale prices also specifies a number of trade practices declared to be unfair and punishable by law.

Enforcement

Enforcement involves two broad phases. First, enforcement of minimum prices to producers requires the audit of payments made to producers by all

plants in the state. Second, enforcement of minimum resale prices and the unfair trade practices provisions of the law require investigation of transactions between distributors and their customers. In addition to the civil and criminal judicial actions that can be brought against violators, the director may revoke or suspend the licenses of distributors in the case of aggravated or repeated violations of the law.

Legal Status of the Control Program

The control program now stands on firm legal grounds.[6] Yet court action does not represent the sole alternative for persons or groups seeking changes or repeal of the law. The state legislature, having established that the fluid milk industry is "vital to public health and welfare," can modify and even abolish the control program. For example, certain groups are trying to have the law amended to abolish "cash-and-carry" pricing which in some areas affects a significant proportion of total retail sales. Bills have been

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[6] A California Supreme Court ruling in 1940 established the constitutionality of the resale price maintenance provisions of the Desmond Act. In two other cases, provisions of the law have been successfully challenged. An early case declared invalid the original provision of the Young Act whereby the authority to fix minimum prices could be delegated to local control boards. Later, a provision whereby the director could assess damages against distributors was held to be an improper delegation of judicial power. One other unfavorable decision held that the director could not establish price differentials between milk distributed in glass bottles and in fiber containers.

Recently the Third District Court of Appeal upheld the state's right to permit cash-and-carry, or drive-in, dairies to sell milk at lower prices than retail grocery stores. This case arose when a group of Stockton grocers challenged the power of the director of agriculture to establish a differential between retail stores sales and f.o.b. plant or ranch sales in the San Joaquin Marketing Area. The San Joaquin County Superior Court ruled against the grocer's group, and the decision was upheld by the Appeal Court.

introduced to prohibit price differentials between categories of consumer sales. These attempts are mentioned here merely to emphasize that a firm legal basis for the present program does not guarantee its indefinite continuance in its present form.

Current implementation of the program, and its relationship to relative prices to producers within and among competing supply areas, are discussed in Section IV. The possibility of major changes in procedures, or even the revocation of the entire program in favor of an alternative system, means that the influence and future of the institutional pricing program must be weighed carefully in predicting future shifts in sources of supply.

THE DEMAND STRUCTURE OF THE LOS ANGELES MILK MARKET

The demand structure for milk at the farm level is more complex than a simple relationship between prices of the product and quantities buyers are willing to buy. Purchasing firms use fluid milk in a number of final products, including manufactured products. The demand for fluid milk by a group of firms is further complicated by the fact that not all of the milk qualifying for fluid consumption can normally be used for that purpose, because of the unsynchronized movements in supply and demand.

Number of Firms

The number of milk dealers, or distributors, has sharply declined in most milk markets in recent years, particularly among firms with small daily volumes. As a consequence the average volume per distributor has increased—a trend that has been further encouraged by increasing total valume in most major markets. Large-volume milk processing and distribution plants have lower unit costs than small plants which may help explain the exit of smaller firms and the consoli-

dation of output among fewer and larger plants.

The total number of plants in California decreased steadily throughout the period 1951–1957 (table 1), particularly those with daily sales of 150 gallons or less. Gains were registered in all size groups selling more than 250 gallons, with only one exception. The tabulation shows the number of fluid milk plants classified according to average daily sales in December. The number of *plants* is shown rather than number of *firms* since individual plants that are units of multiplant firms are recorded separately.

In Los Angeles County the total number of plants increased from 1953. Starting in 1954, the number of plants declined until there were fewer in 1957 than in 1951 (table 1). Significant increases occurred in only two size categories, one being large plants with average daily sales of 5,000 gallons or more.

The number and size of plants and firms distributing milk in Los Angeles County in 1960 were tabulated in a special survey for this study. A total of 125 firms engaged in distributing milk in the county operated a total of 146 plants. Thus, the number of plants is now substantially larger than it was for 1957. The increase in number of firms over previous years is not known. Total sales from plants in Los Angeles County in June, 1959, indicate that 25 firms sold in excess of 100,000 gallons per month, 10 firms sold 50,000 to 100,000 gallons, 17 between 25,000 and 50,000, and 73 less than 25,000 gallons.

In terms of the size categories presented in table 1, increases in plant numbers have been concentrated in the average daily-volume range of 500–5,000 gallons. No increase has been noted in number of plants with average daily volumes of more than 5,000 gallons. This is explained by the fact that many of the new plants are operated by single- or multiple-plant firms that specialize in cash-and-carry distribution.

Table 1. Number of Fluid Milk Plants According to Average Daily Sales of Fluid Milk in December

Year	Average daily sales of fluid milk in December (gallons)								
	Under 50	50–150	150–250	250–500	500–1,000	1,000–3,000	3,000–5,000	5,000–and more	Total
					California				
1951.............	69	100	57	82	68	88	18	49	531
1952.............	42	95	55	80	56	83	23	49	483
1953.............	36	94	59	73	66	82	27	52	489
1954.............	40	70	51	82	66	77	27	56	469
1955.............	35	64	54	89	74	74	26	61	477
1956.............	27	64	54	92	87	61	28	60	473
1957.............	24	61	51	87	84	67	28	59	461
					Los Angeles County				
1951.............	11	26	14	27	15	25	6	16	140
1952.............	7	31	18	24	13	25	6	18	142
1953.............	7	28	21	24	19	27	6	18	150
1954.............	5	11	16	26	25	26	5	19	133
1955.............	5	6	16	30	32	23	5	21	138
1956.............	1	11	15	29	35	20	7	20	138
1957.............	1	6	16	26	32	23	3	23	130

Source: California Crop and Livestock Reporting Service (A 1951–1957).

Type of Ownership and Organization

The 125 firms operating plants in Los Angeles County in 1960 fall into three different types of organization and ownership: regional distributors, cooperatives, local distributors.

Regional distributors. Thus classified are seven firms, operating eight plants in the county. Their operation tends to be large-volume, but their distinctive feature is that they are part of large corporations operating on a regional or national basis. Each of these firms operates at least one other plant in California, and each has at least one plant in the San Joaquin Valley.

The cooperatives comprise two firms, each operating a single plant in the county. The larger of the two, Challenge Cream and Butter Association, is a federated sales organization owned by cooperative marketing associations located throughout the western states. It has eight member associations in California. The other cooperative marketing association operating a milk plant, Superior Milk Producers Association, was organized in 1942. Its plant was constructed in 1952. Before that time, it supplied milk to another distributor and owned no processing facilities itself.

Local distributors include a total of 116 firms, operating 136 plants. Though most of these firms are quite small, 16 have average sales volumes that place them in the largest-size category. Moreover, 15 of these firms operate two or more plants. But, in the case of either the large-volume or multi-plant independents, their operation tends to be local, the basis of the present classification.

Four of the distributing firms are owned by the supermarket chains, to which the products are distributed—the so-called "captive creameries." Two of these are wholly owned subsidiaries of two large grocery chains. One of these firms is considered a regional distributor since the chain operates other plants in California as well as in other states. The second firm operates only a single plant, and is classed as a local distributor. The remaining two distributing firms of this general type are classified as local distributors; they are firms whose capital stock is owned by several supermarket chains, each of which operates independently.

The firms integrated with retail stores provide low-cost handling for the large-volume outlets to whom they are linked. For example, delivery may be made only once daily to the store loading dock; the milk products are then carried into the store, and the refrigerated cabinets are stocked by store employees rather than the route drivers. Selling costs necessary to obtain and hold wholesale store accounts are eliminated, although the firm's brand name may be promoted to establish consumer acceptance. Other firms in wholesale distribution are excluded from placing their products in stores linked to distributing firms in this fashion, unless full product lines are not carried by the "captive" or unless consumer preferences for particular brands force the chains to handle selected products of other distributors.

To counteract loss of wholesale accounts resulting from large-volume wholesale outlets becoming affiliated with captive creameries, several large distributors have made substantial investments in supermarkets to gain exclusive rights to supply these outlets. Although the magnitude of sales under tying arrangements of these types is not known, they tend to improve the efficiency of the firms, since exclusive supply of large-volume outlets lowers distribution costs. In contrast, remaining wholesale customers, especially retail food stores, are under pressure to divide their trade among several competing distributors to take advantage of consumer brand preferences. These multiple deliveries necessarily reduce the average volume of de-

livery per customer. thereby increasing distribution costs.

The importance of captive creameries to this discussion stems primarily from differences on the supply side rather than their impact on efficiency of distribution (Clarke, 1956, pp. 9–13). This is illustrated by the recent addition by one of the captives of approximately 60 retail stores to the group to which it supplies fluid milk products. These wholesale accounts were formerly supplied by other distributors. If the captive firm's procurement pattern for raw product differs from the firms losing the store sales, then the change originating on the selling side is reflected in the buying market as a "shift" in market supply sources.

Sales Outlets

Sales of fluid milk and its products by distributing firms have been classified by the California Crop and Livestock Reporting Service as retail, wholesale, cash-and-carry, peddler, and federal government.

Retail sales are home-delivered sales to final consumers. Wholesale outlets include food stores, restaurants, and institutions. Cash-and-carry sales are sales to consumers at the producer's dairy or the distributor's plant. Sales to peddlers, commonly known as sub-distributors, involve processed and packaged products for redistribution. Federal government sales are contract sales for use on military reservations.

In a special survey conducted for the month of October in each year since 1951, sales have been tabulated by type of trade for plants located in Los Angeles County, regardless of the marketing area in which the sales were made (table 2). Reported sales increased in every year except 1959. As a proportion of total sales, retail sales have declined markedly. This has been offset by an increase in the proportional amount of wholesale sales. For the three years in which a more detailed tabulation is available, cash-and-carry sales have shown a slight proportional increase, sales to peddlers have shown little relative change, and federal government sales have shown a small proportional decrease.

These data must be accepted with caution. In the first place, routes of some distributors are "combination" routes; hence, it is extremely likely that not all reported sales are properly classified as to types of trade. Secondly, the surveys do not include *all* plants in the county; hence, the total sales figure is biased downward. In addition, plants excluded are necessarily neither the same in number nor identity in succeeding years.[7] Sales of plants not included in the surveys are primarily small-volume distributors whose sales are largely cash-and-carry. Thus, cash-and-carry sales are likely to be relatively larger than shown in the table, and other categories of sales might also be overstated.

By using additional information it was possible to estimate total sales of fluid milk of all plants in the county at about 17,900,000 gallons for June 1959. Percentages of total sales, by type of trade were:

Wholesale	57
Retail	26
Cash-and-carry	10
Peddler	5
Federal government	2

While this supports reservations concerning the accuracy of the data on sales through alternative outlets, it is still likely that their trend over time should not be significantly altered.

The nature of outlets of distributors directly influences existing market supply patterns and their potential adjustment. For example, all milk sold f.o.b. ranch

[7] Each distributor who files a monthly statistical report with the California Crop and Livestock Reporting Service is requested to submit a supplementary report for October of each year to provide data on sales by type of trade. Compliance is voluntary.

(cash-and-carry) must be produced at point of sale. By contrast, such factors as weekly and seasonal sales variations and the desire to maintain reserve supplies of market milk to meet these needs encourage distributors utilizing other outlets to maintain sources of supply over a wider geographic area.

Sales Concentration

Concentration, as used in this bulletin, refers to the extent to which a specified *number* of firms accounts for a given proportion of the *sales* of the market group. It is concentration in this sense that, according to price theory, is an important determinant of the market power of an individual firm. Other things being equal, the exercise of monopoly power is more likely when a small number of leading firms accounts for a large proportion of the total sales of their market group.

Clarke (1956, p. 6) reports that in 1954 the three largest handlers accounted for the following percentages of total sales of fluid milk in the marketing areas indicated:

Sacramento 66
Fresno 59
San Francisco 59
San Diego 47
Alameda-Contra Costa 44
Los Angeles 35

This degree of concentration of sales is not unique to California markets, nor is it tending to increase greatly over time. In fact, data for the Los Angeles Marketing Area for June, 1959, indicate that the three largest distributors again accounted for 35 per cent of total fluid milk sales in the area. Thus, although concentration in this area was already lower than in any other major market in California, it has shown no increase in the last several years. Half of the sales are made by the five largest firms, and the smallest 100 firms account for only about 10 per cent of sales (figure 2).

Table 2. Sales of Fluid Milk by Los Angeles County Plants in October, According to Type of Sales Outlets

Type of outlet	1951	1952	1953	1954	1955	1956	1957	1958	1959
	percent of total fluid milk sales reported by Los Angeles County plants								
Wholesale	55	53	56	53	55	59	57	59	60
Retail	37	39	36	37	35	31	28	26	26
Cash-and-carry	*	*	*	*	*	*	6	6	7
Peddler	*	*	*	*	*	*	5	5	5
Federal government	*	*	*	*	*	*	4	4	2
Total sales (gallons)	12,689,950	12,171,746	12,999,726	13,898,911	15,431,141	16,525,914	17,273,023	17,720,137	17,347,670

* Data not available.
Source: California Crop and Livestock Reporting Service (A 1951–59).
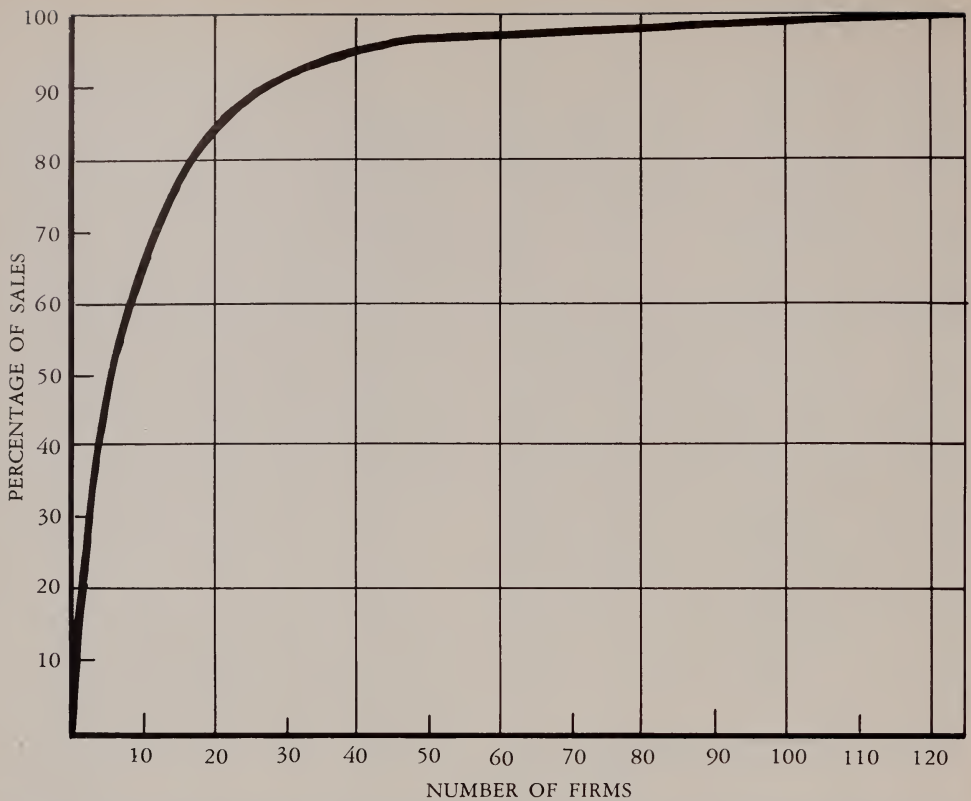
Figure 2. Cumulative distribution of milk distributing firms in Los Angeles County by percentage of fluid milk sales in the Los Angeles County marketing area, June 1959.

Market Type and Supply Adjustments

Although the number of buying firms included in this study is rather large, moderately high sales concentration indicates a market with a few large buyers and a substantial fringe of small firms. Mutual interdependence is undoubtedly recognized among the major firms who compete for large segments of wholesale and retail sales. While price theory suggests that a market of this type may offer a favorable setting for collusion, entry of new firms is easily induced and likely to be followed by periods of excessive competition, in which large firms attempt to consolidate their market position by forcing small competitors out of business. Enforcement of a minimum resale price program and control of unfair trade practices under state legislative authority has created an economic environment free of this type of structural instability, even in the face of excess industry capacity and continuous entry.

Since manipulation of price and non-price variables is highly restricted by institutional controls, making as many sales as possible—in a context of classified pricing, fixed minimum gross margins, and size economies—has become a major short-run objective of distributing firms. The buying firms want to procure a supply of milk which at any time is larger than the minimum required to ensure that all fluid requirements of the market are met.

Procurement practices of buying firms

[20]

become an important factor in the supply of milk forthcoming from a given producing district. Resulting geographic utilization patterns, together with current pricing and pooling procedures, have an important effect on prices received by producers relative to other producers and other areas. Net producer prices play an important role in firm decisions at the producer level, including location as well as level of production, and they affect the efficiency with which resources are allocated spatially to the production of market milk.

THE SUPPLY STRUCTURE OF THE LOS ANGELES MILK MARKET

In 1930, the supply structure in the Los Angeles Market was as follows (Spencer, 1931): Almost the entire fluid milk supply came from producers within 60 miles of the city (figure 3). Fluid cream above that separated from locally produced milk, was regularly shipped into the market from plants 100 miles or more away. Slightly more than 1,400 dairies, with 80,000 cows, were approved to supply milk to the county (table 3)—69 per cent of the approved dairies and cows were located in the county itself.

In that year, 20 country plants were shipping market cream to Los Angeles. Of these, 7 were in Tulare, 3 each in Kern and Merced, and 2 each in Kings and Santa Barbara, and 1 each in Fresno, Ventura, and Imperial counties. Thus, 16 of the 20 plants shipping cream were in the San Joaquin Valley (figure 4). This situation was a classic example of the specialization of supply zones around an urban market. The most intensive producing area was in the county itself. Cream and manufactured dairy products were obtained from the outlying valley region.

Regular milk shipments from Kern County, in the San Joaquin Valley, began in September 1928 when a firm distributing milk and cream in Los Angeles began to ship milk to the city from a country plant in Kern County, 115 miles away. In December, 1930, another creamery in Kern County began to ship milk to Los Angeles, and a third prepared to do so (Spencer, 1931). Still, the great bulk of the supply for the county was produced in the local area, mostly in the southeast portion of the county and in El Monte, Pomona, Chino, and Ontario to the east, less than 50 miles from city plants. Distances for shipments from the San Joaquin Valley are at least twice that far.

Consumption of fluid milk began to drop in 1929, as a result of the depression. This postponed additional adjustments in the supply area for Los Angeles in the 1930's. Increased production, in

Table 3. Number of Dairies Approved to Supply Milk to Los Angeles County, and Number of Cattle on Approved Dairies by County, 1930

County	Dairies	Cattle	Per cent of dairies	Per cent of cattle
Los Angeles	978	55,290	69	69
Orange	105	5,147	7	6
Riverside	70	4,498	5	6
San Bernardino	172	11,232	12	14
Ventura	2	391	0.1	0.5
Kern	82	3,347	6	4
Total	1,409	79,905		

Source: Spencer (1931).
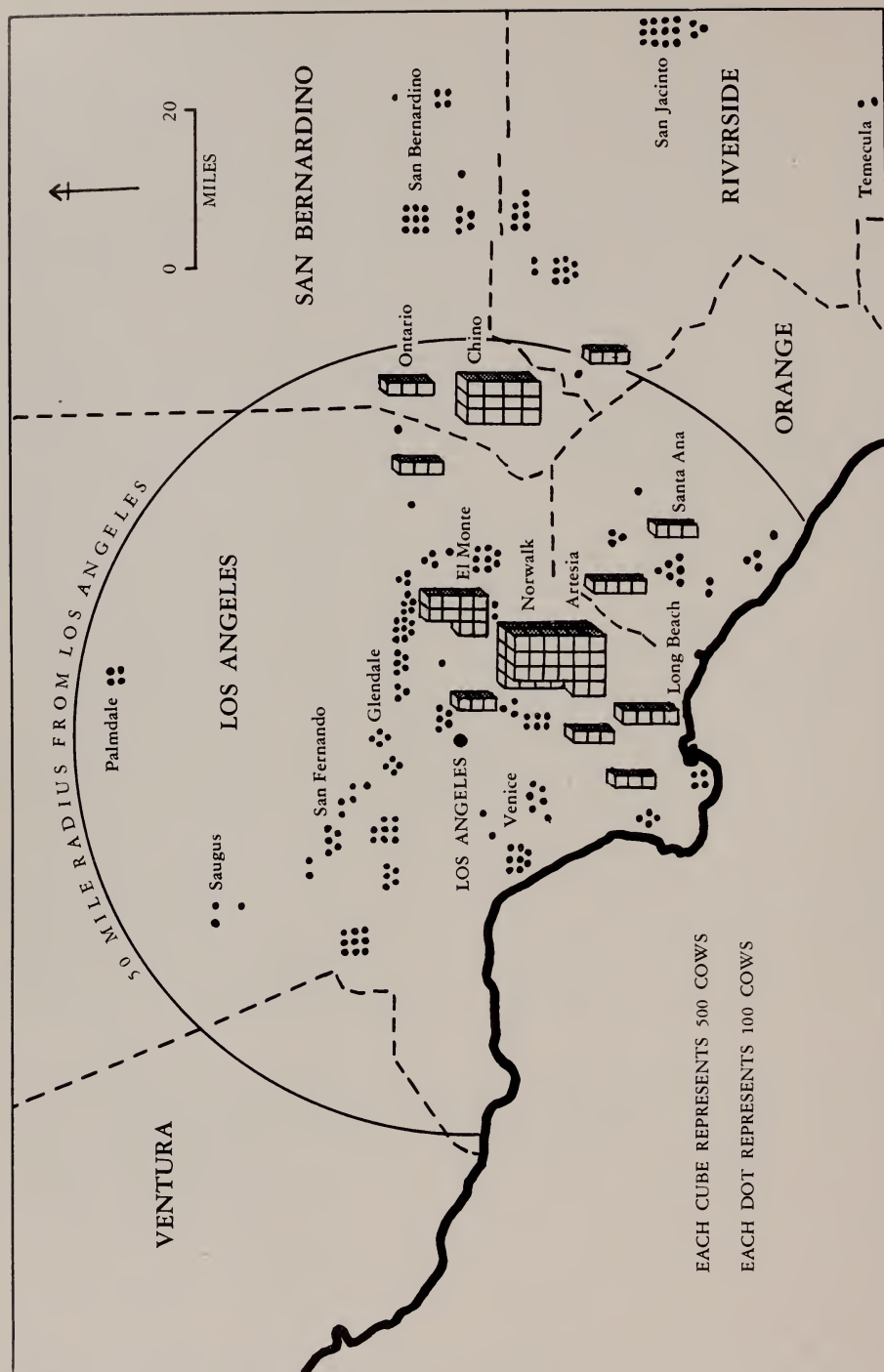
Figure 3. Geographic organization of the Los Angeles milkshed 1930.

Figure 4. Location of plants shipping cream to Los Angeles County, 1930.

the face of reduced consumption and drastic price decreases, placed the Los Angeles County dairy industry in a surplus position throughout the depression and early war years. In 1942, fluid milk deliveries by producers in Los Angeles County were 30 to 35 per cent above the needs of receiving plants. By 1943, military use and increasing civilian consumption led to resumption of shipments from the San Joaquin Valley to Los Angeles. In January 1944, shipments from the San Joaquin Valley were 12 per cent of the total supply for the market (Weeks, 1945, p. 108). This raised the question of whether the San Joaquin Valley should be looked upon only as a source of supplementary fluid milk for the Los Angeles area, or whether it was to become a competing source for the major supply.

Southern California production-consumption balance. Despite great monthly variation and a pronounced seasonal pattern, the deficit of production of fluid milk in southern California generally increased until 1957 (figure 5). The deficit leveled off in that year, increased mildly in 1958, and dipped sharply in 1959.

The balance is computed monthly by the California Crop and Livestock Reporting Service for Los Angeles, Orange, San Bernardino, Riverside, San Luis Obispo, Santa Barbara, Ventura, San Diego, and Imperial counties. The figures show the extent to which this entire 9-county area must rely on surplus production in the San Joaquin Valley to meet its needs for fluid milk.

San Joaquin Valley shipments. For the period in which data are available, bulk shipments from the San Joaquin Valley to southern California plants have represented 15 to 20 per cent of total use in the deficit region. As a percentage of use in the receiving region, the shipments show relatively little monthly variation, and only a mild seasonal pattern.
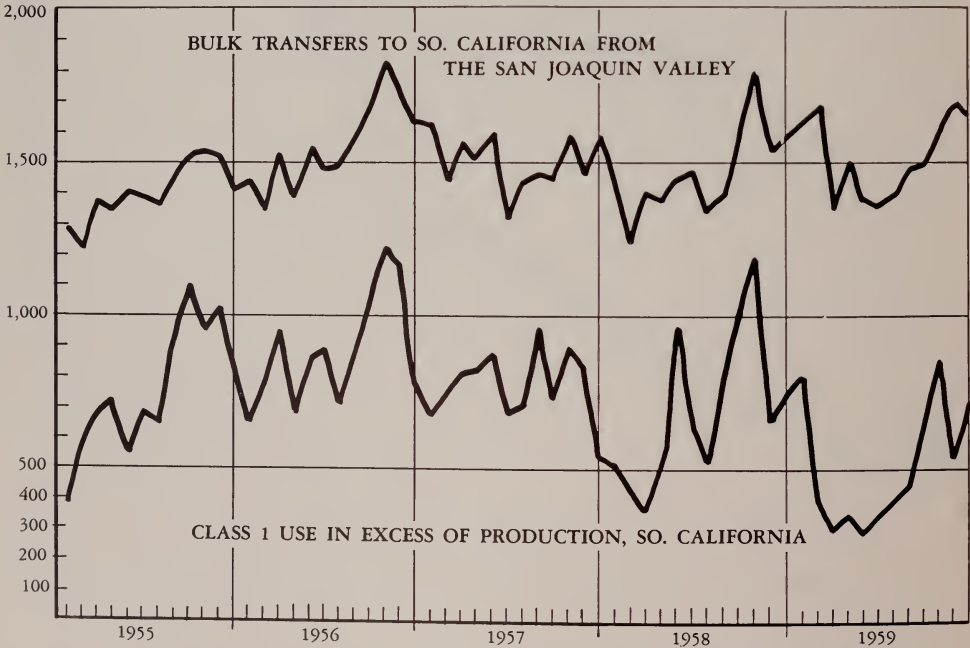
Figure 5. Monthly deficit of market milk fat in Southern California and bulk transfer from the San Joaquin Valley. Source: California Crop and Livestock Reporting Service (B1955–59).

The shipments are larger in any given month than the size of the deficit. In percentage terms, the deficit has varied from 22 to 67 per cent of shipments. The general seasonal pattern in the shipments is similar to that found in the consumption deficit; peaks and troughs in the deficit and shipments tend to occur together (figure 6).

More detailed data are needed to measure the importance of Los Angeles plants as receivers of Valley shipments. Receipts by Los Angeles plants of bulk shipments of milk and cream from the San Joaquin Valley were tabulated for 6 separate months spanning a 2-year period. A summer and a fall month were chosen for each year, in line with the seasonal variation for shipments observed above. Receipts by Los Angeles

plants of bulk shipments from San Joaquin Valley plants were found to constitute the following percentages of total Valley shipments to Southern California for the months indicated:

October	1956	94
June	1957	97
October	1957	96
June	1958	96
October	1958	92
June	1959	97

These results show that a very high proportion of all bulk transfers of milk and cream from the San Joaquin Valley to southern California is received in Los Angeles plants. Valley shipments are almost entirely plant-to-plant bulk transfers of milk and cream. This is in contrast to much of the Valley milk production used in the San Francisco Bay
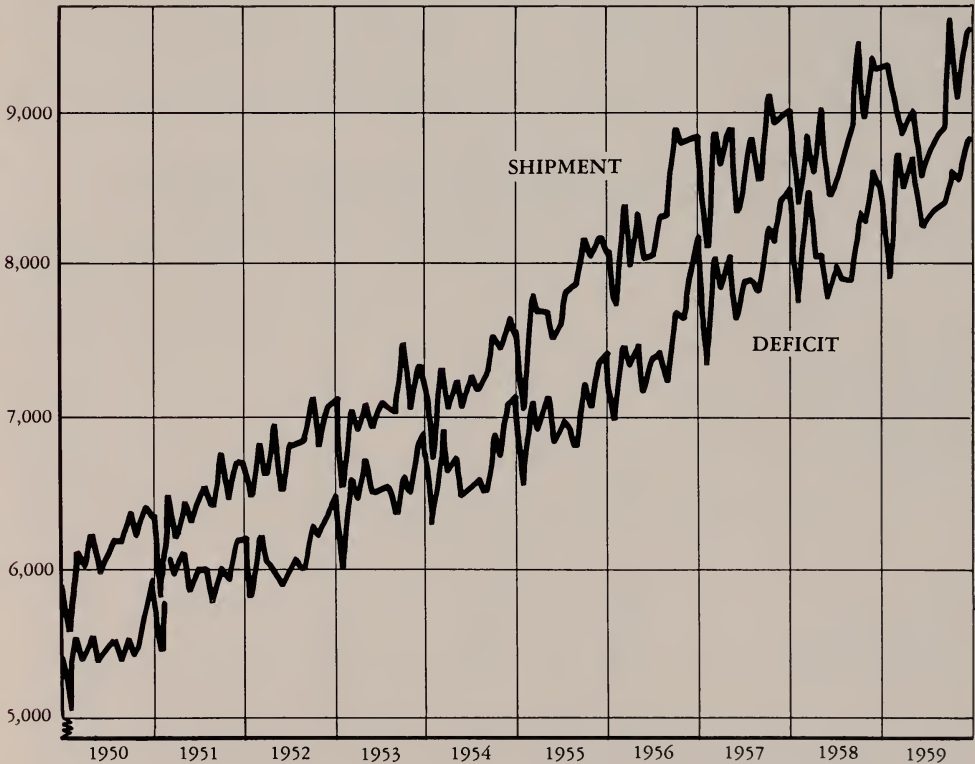
Figure 6. Class 1 use, production of market milk fat, southern California, monthly, 1950–1959.

[25]

Area. which is transported from a producer's dairy directly to a city plant without first being received at a Valley plant.

The Southern Milkshed—
Production Adjustment
Within the Area

The milkshed can be conveniently divided into two broad areas: a local producing region and an outlying Valley region, referred to here as the southern and northern supply regions. The impact of rapid population growth and economic development on milk production in the local portion of the milkshed is discussed in this section.

Los Angeles County. The number of dairy cows in Los Angeles County is now about twice as great as in 1930, though there are less than half as many dairy farms. Milk production is the most important agricultural enterprise in the county. Districts of milk production are shown in figure 7

Dairy production in 1930 was widely dispersed throughout the county. The southeastern section was the most important producing area, but the San Gabriel and San Fernando valleys and the southwestern section were also important. By 1950, urban encroachment had forced large-scale movement of dairies from some sections, particularly the San Gabriel Valley and southwestern areas (table 4). A continuing concentration of dairy cattle in the southeastern district, brought about by an increase in herd size more than sufficient to offset the decrease in number of herds, increased the number of dairy cows in the county in 1960 over 1930, even in the face of declining numbers in all other areas except the San Fernando Valley.

As population of the county is projected to increase to 9 million by 1975, 50 per cent above 1960, the demand for fluid milk, unless consumption habits will change, will also continue to increase. At the same time, further population growth will intensify economic pressures on remaining dairy producers and may force them out of the county. Even though production has increased by 50

Table 4. Geographic Distribution of Commercial Dairies and Milk Cows, Los Angeles County, 1930, 1950, 1960

District	Number of dairies			Percentage increase or decrease	
	1930	1950	1960	1930–1960	1950–1960
Southeast...................	542	445	358	− 34	−20
San Gabriel Valley.............	284	77	36	− 87	−53
Southwest...................	112	50	26	− 77	−48
San Fernando Valley..........	87	24	15	− 83	−38
Antelope Valley...............	14	7	3	− 50	−57
Total..................	1,039	603	438	− 58	−38
	Number of cows				
Southeast...................	27,405	69,319	76,535	+179	+10
San Gabriel Valley.............	14,300	11,075	7,430	− 48	−33
Southwest...................	5,700	5,605	5,335	− 6	− 5
San Fernando Valley..........	4,400	5,948	5,795	+ 32	− 3
Antelope Valley...............	700	775	625	− 11	−19
Total..................	58,905	92,722	95,720	+ 62	+ 3

Sources: 1930—Spencer (1931, p. 21).
1950—County of Los Angeles (1951, p. 5).
1960—Records of the Los Angeles City Health Department and Los Angeles County Health Department.

Figure 7. Major milk producing districts in Los Angeles County.

per cent since 1941, the rate of increase has not been sufficient to match the growth rate of consumption. As a result, areas outside the county have become increasingly important as sources of the supply of fluid milk.

Table 5 presents the changing production pattern for the entire Los Angeles southern milkshed (figure 8), from which Los Angeles plants receive milk directly from producers. Two areas stand out, in their importance as pro-

Table 5. Shifts in Location of Production, Los Angeles Southern Milkshed, 1930, 1950, 1960

District	Number of commercial dairies			Percentage change	
	1930	1950	1960	1930–1960	1950–1960
S. E. Los Angeles-Orange.................	577	497	449	− 22	− 10
Chino Valley...............................	117	99	230	+ 98	+132
Mojave River Basin........................	*	*	13	..	..
San Jacinto-Hemet........................	33	*	19	− 17	..
Los Angeles, other.........................	497	158	80	− 84	− 49
Orange, other..............................	70	35	45	− 36	+ 29
San Bernardino, other.....................	31	*	40	+ 29	..
Riverside, other...........................	46	*	29	− 37	..
			905		
	Number of milk cows				
S. E. Los Angeles-Orange.................	29,305	77,430	101,685	+247	+ 31
Chino Valley...............................	7,600	15,000	48,810	+542	+225
Mojave River Basin........................	*	*	2,440	..	..
San Jacinto-Hemet........................	1,500	*	4,060	+171	..
Los Angeles, other.........................	25,100	27,403	19,185	− 24	− 30
Orange, other..............................	3,500	*	10,235	+192	..
San Bernardino, other.....................	2,000	*	5,540	+177	..
Riverside, other...........................	3,000	*	3,675	+ 22	..
			195,630		

* Data not available.
SOURCES: 1930—Spencer (1931, p. 21).
　　　　1950—County of Los Angeles (1951, p. 4).
　　　　1960—Health Departments, Los Angeles City, Los Angeles County, Orange County, San Bernardino
　　　　　　County, Riverside County.

ducing centers and in the changes they have undergone: the southeastern Los Angeles-Orange district, and the Chino Valley district.

Southeastern Los Angeles-Orange district. The most concentrated dairy section, number of dairies, number of cows, and production of milk, includes the southeastern portion of Los Angeles County and the adjacent northwestern section of Orange County. The area is economically and geographically homogeneous; it is close to large Los Angeles plants—25 miles or less; it is a flat, low-lying plain with an all-year-around temperate and equable climate; and is highly favorable to a stable, high-level production of milk. Its major disadvantage is its poor drainage, making it susceptible to flooding from heavy rains.

The number of dairies in this area has declined moderately since both 1930 and 1950. In contrast, the number of cows has more than tripled since 1930; the increase has not been as sharp since 1950 and was probably highest between 1940 to 1950. Nevertheless, the number of cows in the area has increased by 30 per cent since 1950—the period of the highest rate of population growth ever achieved in Los Angeles and Orange counties.

Chino Valley district. This second-most important producing district in the southern milkshed includes the south-western part of San Bernardino County and the northwestern corner of Riverside County. It is bounded on the south by the Santa Ana River, on the north by the San Gabriel Mountains, on the west
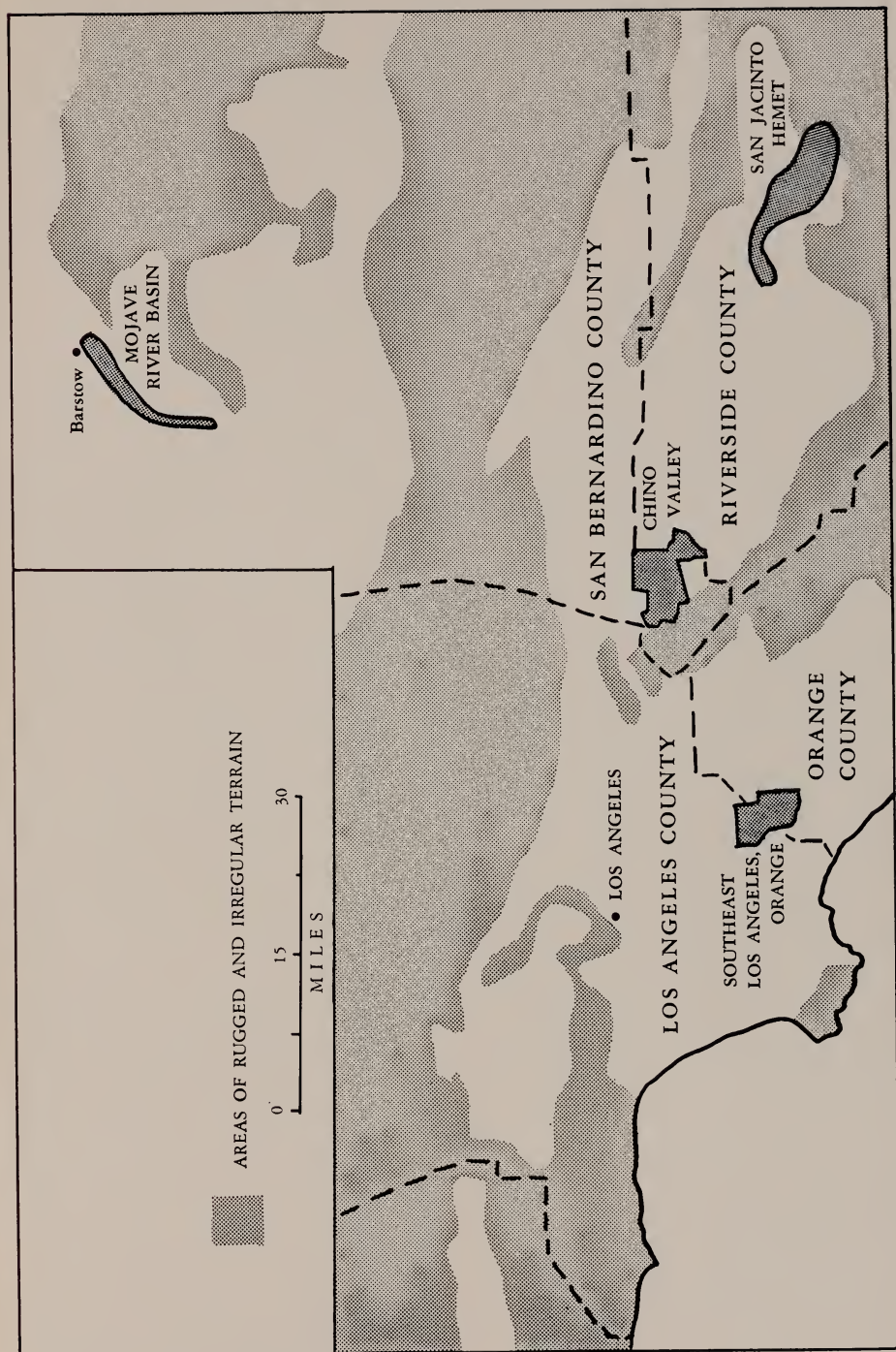
Figure 8. Milk producing districts in the southern Los Angeles milkshed.

by the city of Pomona and the Chino Hills. The district is part of the upper Santa Ana basin, usually called the San Bernardino Valley. The climate is only slightly less desirable than that of the southeastern Los Angeles-Orange area; summer temperatures are higher and winds stronger. Distance from Los Angeles City plants is about 50 miles, but freeway routes minimize additional transport problems.

In 1930, the Chino Valley district contained 117 dairies and 7,600 cows on commercial dairy farms. By 1950, the number of cows had doubled, the dairy numbers declined to 99. Then, within ten years, the number of dairies more than doubled, and the number of cows more than tripled to 48,810. This increase was caused by dairymen moving in from Los Angeles County. Since 1950, the increase has averaged more than one dairy per month, bringing the total number in this district to 230 dairies.

Other producing areas. Two other areas, identified in this study, are the Mojave River Basin in the Mojave Desert north of the San Bernardino Mountains, about 125 miles from Los Angeles, and the San Jacinto-Hemet area in western Riverside County, about 90 miles from Los Angeles. Available data to measure changes in these areas are not complete, but both have declined moderately in number of dairies since 1930, while the number of cows has increased. Currently, 13 dairies and 2,440 cows are located in the Mojave River Basin, and 19 dairies and 4,060 cows are in the San Jacinto-Hemet area. They are included in this study mainly because of their potential as producing districts.

The other producing areas in the southern milkshed cover the sections of the four counties not included in these major areas. At present, there are 80 dairies and 19,185 cows in Los Angeles County outside of the southeastern district. The number of dairies in this area since 1930 has declined drastically, but remaining herds have increased so that there was only a moderate decrease in number of cows (table 5). The remaining sections of Orange, Riverside, and San Bernardino counties total about 114 dairies and 19,450 cows, up from 8,500 in 1930. These tend to be clustered around the larger urban areas in the counties, including Santa Ana-Westminster, Riverside-Arlington, and San Bernardino-Redlands.

The Northern Milkshed— Production Trends in the San Joaquin Valley

In terms of total commercial milk fat production, the San Joaquin Valley is the most important dairy area in the state. In 1959, it provided 39.5 per cent of total commercial milk fat production in the state—up from 37.7 per cent in 1952. It is followed closely by the southern California region, which produced 35.4 per cent in 1959—up from 32.6 per cent in 1952. The relative positions of the two would be reversed if only market milk production were considered, reflecting the importance of the Valley area as a manufacturing as well as market milk producing area. However, milk for market uses has increased, both absolutely and as a proportion of total production, while manufacturing milk production has declined in both senses.

Dairying, although widespread throughout the Valley, is heavily concentrated in the Tulare-Hanford-Fresno and Los Banos-Newman-Modesto areas. A smaller concentration is found in the Bakersfield area. On this basis, the Valley is sometimes divided into upper (northern) and lower (southern) subregions. The lower valley would include the counties of Madera, Fresno, Kings, Tulare, and Kern; the upper, Merced, Stanislaus, and San Joaquin. Shipments of market milk and cream to Los Angeles plants originate from as far north as Modesto, a distance of about 315 miles.

Other shipments originate in Bakersfield, a distance of about 110 miles. The bulk of shipments originate in the lower valley area.

Type of Production Organization

Market milk dairies in California show basically two types of production activities:

1. *Dry-lot* — a factory-type operation, wherein all feed is purchased from off the farm; no replacements are raised on the property, which necessitates extensive buying and selling of cows to maintain the milking herd and production level.
2. *Pasture* — size of herd is dependent on the carrying capacity of the pastures on the farm; hay and concentrates are used to supplement pastures and may be purchased; replacement stock is raised on the farm.

The dry-lot type developed first, and is now dominant, in the southeastern Los Angeles-Orange area, and in the remainder of Los Angeles County. It reflects the high land values in this urbanized area which led dairymen to conserve this expensive input. In the Chino Valley and outlying producing areas in Orange, San Bernardino, and Riverside counties, combination dry-lot and pasture operations are more widespread. Here, some limited acreage is often used for irrigated permanent pasture or other feed production. But the herd is typically larger than can be supported by on-farm feed production, requiring the purchase of supplemental hay and concentrates. Pasture is used for grazing by dry cows, and perhaps some replacement stock, and some home-grown forage may be available for the milking cows. In both instances, the dairyman usually concentrates his management almost exclusively on milk production.

The dairy enterprise in the San Joaquin Valley may represent only one of several enterprises on a farm, and may or may not dominate. Other enterprises may be related to the production of milk, such as feed production and raising replacement animals, or unrelated, such as field crops and fruit and vegetable production. Historically, many producers in the San Joaquin Valley developed operations of this type. The trend in all major producing districts included in this study is toward some variant of the large, specialized dry-lot operation.

Number and Size of Dairies

On a statewide basis, the number of market milk dairies has recently declined very slowly, from 4,320 in 1953 to 4,146 in 1958. An estimated 1,708 of these were in the San Joaquin Valley, and a further decline to 1,703 in 1959 is reported. (California Crop and Livestock Reporting Service, C 1958, E 1959). In 1958, 905 of these dairies were located in the four-county southern area.

The size of dairy herd varies significantly both within and between the two segments of the milkshed. Extremes observed in the southern milkshed range from a low of 20 to a high of 1,000 cows per herd. The average size of herd in this region is 216. Average herd size in the San Joaquin Valley is significantly smaller. Moreover, herds in the upper counties of the valley tend to be somewhat smaller than herds in the lower valley counties. Since published data on numbers of dairy cows on farms do not differentiate between market and manufacturing milk producers, precise herd sizes for market milk dairies in the San Joaquin Valley are not known. Annual averages for herds included in production cost surveys conducted quarterly (Bureau of Milk Stabilization, 1959) show 133 and 153 as respective average herd sizes in the upper and lower valley districts for 1959. Although the herds included in these surveys cannot be considered as representative of the valley, the results should be sufficient to indicate broad inter-area differences in average herd sizes.

In structural terms, even the largest producers are relatively small when compared to industry aggregates. For example, the 10 largest dairies in the southeastern Los Angeles-Orange district include a total of 7,350 cows, or about 7 per cent of milk cows in the district, and less than 4 per cent of cows in the southern milkshed. Results would be similar if concentration were measured in other producing areas. This implies that the number of firms on the supply side approaches the theoretical large-numbers case, wherein each firm produces an insignificant proportion of the total industry output. But producers do not sell in a market characterized by pure competition; in fact, conditions of sale and price determination depart markedly from the competitive model, as will be discussed in Section IV.

Producer Organizations

Besides the two producer cooperative marketing associations that operate milk plants and are classified as distributors, there are three other producer organizations in the Los Angeles area. Of these, two are cooperative bargaining associations and the other is a general trade association.

The largest of the cooperative bargaining associations, the Protected Milk Producers Association, was organized in 1938. In its current status, the organization acts as exclusive supplier of milk to the Los Angeles plant of Arden Farms. The organization now has 120 members, located in the four-county southern milkshed.

The second bargaining cooperative, Central Milk Sales Association, is the remnant of an organization formed in 1938, following the suspension of the Young and Desmond acts, as a federation of 10 captive shipper groups. At that time, the organization handled 95 per cent of all milk produced in the Los Angeles area. When the control program was reinstated, the major purpose of the federated organization disappeared. By 1942, membership had declined and the Protected and Superior groups had withdrawn. The association presently has 41 members. It owns no marketing facilities, and sells all members' milk to six distributors as bulk unprocessed milk. Some members hold their own contracts, whereas others market their milk through the association.

The Milk Producers Council, the general trade association, was organized in 1949. About 130 dairymen in the southern milkshed belong to this group whose main purpose is to represent the producers in this area in actions by the Bureau of Milk Control. The association finances a cost-of-production survey, and assembles cost data for milk price hearings.

THE SUPPLY ADJUSTMENT PROBLEM IN THE LOS ANGELES MILK MARKET

Los Angeles milk plants currently receive about 95 per cent of their total supply of unprocessed milk and cream from the northern and southern supply areas. The two areas will continue to be the major sources of supply. (See Section IV for a detailed analysis.)

Most of the remaining 5 per cent is drawn from the coastal counties of Ventura, Santa Barbara, and San Luis Obispo. Production levels in these three coastal counties are not expected to increase to an extent that would make them an important contributor to the supply for Los Angeles plants. Growth in local consumption will limit surplus production, especially in Ventura and Santa Barbara counties. Also, the limited land and water resources in these two counties are being devoted increasingly to urban and industrial uses, or planted to citrus and vegetables. Favorable climate and natural pasture are influencing production in the Santa Maria area. Even so, the supply of concentrates, seasonal shortages in natural pasture, and a

scarcity of feed production on irrigated land indicate that the area could not achieve large-scale production increases without imported feedstuffs. In addition, distances to Los Angeles up to 200 miles, compound the locational disadvantages of milk producers in the area. Little more than modest expansions of production for outside markets can be expected in the three counties. However, this area is assuming some significance to the southern supply area as a source of replacement cattle.

San Diego County, being at present both a feed and milk deficit area, is no potential source of supply. In fact, the San Joaquin Valley is currently supplying San Diego's deficit requirements.

The presence of San Diego as a deficit market minimizes the potential development of the Imperial Valley as a source of supply for Los Angeles plants. Total commercial milk fat production in Imperial Valley declined to 988,000 pounds in 1958, from a high of 1,236,000 pounds in 1954 (California Crop and Livestock Reporting Service, 1958, p. 23). Although the Imperial Valley is an important source of alfalfa hay for producers in the southern milkshed, extreme summer temperatures are unfavorable to milk production and handling. Also, Los Angeles plants are 215 miles away, and San Diego plants only 120 miles; this suggests that any production increase is likely to be absorbed in the nearer deficit market.

Thus, within an over-all context of a level of production in California at least adequate to supply its requirements for fluid milk and cream, prevailing raw-product supply patterns for Los Angeles plants are likely to continue. Present supply areas will have to increase production to meet expanded fluid milk requirements, because population and per-capita consumption are expected to grow. The supplies to be forthcoming from the two major competing regions will be affected by these main factors: transport, feed, and labor costs, relative production efficiencies, investments, and alternative resource uses. Also considered must be distributor procurement policies and the state minimum-price control program.

III. COSTS AND LOCATION ADJUSTMENTS

MARKET MILK PRODUCTION COSTS for an individual producing unit at any given time are a complex function of:

- location of production
- quantity, quality, and prices of productive inputs available to the firms
- managerial ability of the operator, and
- the internal operating efficiency as affected by the size of operation and choice of technology. Variations in these factors can lead to production costs that differ among firms or among producing regions.

Production costs are difficult to calculate and interpret. Joint costs over time, for durable inputs and among products for multiple-enterprises operations, can be allocated in many ways—each as defensible and at the same time as arbitrary as the other. As residual claimants on the net income of the farm, operator's labor, management, and owned resources receive returns that are "price determined" rather than "price determining." Long-run volume-cost relationships can be confused and combined with rates of utilization of fixed plants.

These factors create serious difficulties for study of changing regional supply relationships in a context of empirical cost of production comparisons between competing areas based on accounting data. Production costs relevant to area supply adjustments may have little connection with current costs in an accounting sense. This may be equally true for evaluation of the impact of shifting interregional supply relationships on the aggregate efficiency of the industry.

A more valid approach involves synthesis of production costs for standard operations as a basis for interregional comparisons. Such synthesis uses input-output ratios expressed in physical terms. By applying appropriate rates, the estimates of physical input-output relations can be converted to estimates of production costs. If underlying input-output ratios are constructed on the basis of efficient production organization and utilization of inputs, then the cost relationships so obtained will show the lowest cost that can be attained with the specified production organization and prices of the inputs.

So determined, production cost estimates will provide a basis for finding the optimum location for a given unit based on cost considerations. In addition, area differentials in production costs can be allocated to underlying differences in resource productivity or geographic variation in input prices. Locational advantages or disadvantages of the two competing regions can then be evaluated and used as a basis for projecting minimum-cost geographic production and utilization patterns for the milkshed.

PLANT ORGANIZATION, INPUTS AND OUTPUTS

A market milk "plant," for the specialized factory-type production developed in this milkshed, consists of a milking barn; a milk house where milk is stored and cooled to await pickup; a system of corrals and lanes for feeding, holding, and moving cows to and from the milking barn; auxiliary buildings, such as hay barns, other feed storage buildings, and calf barns; equipment to feed and handle animals, and to clean and maintain buildings and corrals; and finally, equipment to extract, cool, and store milk.

Feedstuffs used in the production of milk are concentrates and forages, also called roughages. Most concentrates, such as grains, seed meals, and molasses, are fed in commercially prepared mixtures of several components. Their nutritive content is high relative to bulk; they are usually the most expensive source of nutrients. Forages, which have a lower nutritive content relative to bulk, may be fed as hay or green feed. Pasturing of forages is common under other than dry-lot types of organization. Hay, usually alfalfa, is the main type of roughage fed to dairy cows in the milkshed. Normally, pasture is used only when it can be produced on the farm. In some cases, fresh chopped alfalfa or other green feed is fed to cows in corrals to replace some of the hay in the ration.

Labor and management are required to coordinate and carry through the production process. The choice of plant and equipment greatly affects labor productivity; substitution between alternative technologies and labor is possible over a wide range. In addition, herd size and level of production affect the efficiency of labor use within a plant (Phelps, 1960).

The amount of milk produced by a given unit is, of course, a function of the level of output per cow and the number of cows milked. Either of the underlying determinants may conceivably be varied to adjust the firm's level of output per time period. Cost experiences would differ with the manner in which output is varied.

Output Per Cow

Output of milk by a particular cow is a complex function of feeding and management practices—both past and present—age, breed, inherent productive capacity, and internal physiological factors. External factors such as temperature, humidity, and wind also can influence a cow's production.

The average level of output per cow of 10,400 pounds per year, which was used in cited studies as a basis for projecting total cow numbers in California by 1975, was approximately achieved or exceeded in 1958 by DHIA producers in all the important districts in the milkshed (table 6). This could mean either that additional expansion in production through increased output per cow is limited or that the average level of production forecast for 1975 is too conservative. DHIA figures indicate that average output per cow in 1959 increased by at least 5 per cent over 1958 levels in all important producing districts in the milkshed (California Dairyman, 1960, p. 26). This suggests that the 1975 forecast is likely to be substantially exceeded.

Production levels in the southern milkshed generally exceed those in the northern region. This may be due to one or more of the following reasons:

• The inherent quality and productive capacity of cows milked may differ.

• Environment, particularly climatic conditions, may differ.

• Feeding and management practices may differ.

The importance of *inherent quality* on high production was recognized early by many producers in the Los Angeles area, particularly in dry-lot production. It led to an early emphasis on obtaining high-capacity stock. Of course, dependence on cows shipped in from other areas reduces the degree of control that the producer can exercise over the quality of herd replacements. In recent years, herd improvement programs in the San Joaquin Valley have expanded rapidly. In fact, the common practice whereby the Valley producer establishes an artificial breeding program and raises his own replacement animals now gives him a decided advantage in the control of quality of his animals. Recognition of this, and difficulty in securing large numbers of high-quality replacements, has led some producers in the southern milkshed to institute an artificial breeding program and contract for raising replacement animals in outlying areas.

Differences in *environment* may be responsible for different output when animals of the same quality, fed and managed identically, are located in different geographic areas.

The mild and equable climate in the

Table 6. Herd Size Production Levels, 1958

County	Number of herds on test	Average number of cows per herd	Average pounds milk per cow per year	Average pounds milk fat per cow per year
Northern milkshed				
Madera	49	131	11,407	447.0
Fresno	118	152	10,206	410.3
Kings	54	101	10,182	388.4
Tulare	236	74	11,111	417.5
Kern	40	165	11,538	440.6
Southern milkshed				
Los Angeles	132	246	12,816	481.3
Orange	29	242	12,974	482.5
Riverside	22	164	12,468	476.7
San Bernardino	63	215	12,198	461.3

SOURCE: DHIA Records, Berkeley, California Agricultural Extension Service.

southeastern Los Angeles-Orange produc- ing district is ideal for high-level sus- tained production and far outweighs such climatic handicaps as winter rains and unseasonably low temperatures. No other major producing district is so favorably situated. The Chino Valley, though still in the coastal plain, experiences more ex- treme temperatures, both winter and summer, as well as high winds in certain seasons. The high and prolonged sum- mer temperatures in the San Joaquin Valley decrease production and create a problem in sustained year-round produc- tion. Adverse summer influences can be partially offset with various shade and cooling devices. Winter rains present the same problems found in Los Angeles.

Feeding rates and composition of the ration are the third reason for regional differences in average production levels. Feeding practices show a pronounced variation in both level and composition of feeding. Currently, concentrates sup- ply about 38 per cent of total digestible nutrients in the local Los Angeles pro- ducing area, with alfalfa hay supplying the other 62 per cent (table 7). With present knowledge, much further in-

crease in either total feed input or ratio of concentrate to hay cannot be expected in this area since present levels approach the stomach capacity of the animals (McCorkle, 1960, p. 6). However, recent experimental studies with high-energy rations on other types of livestock may lead to further changes in feeding prac- tices of dairy cows, provided product prices and feed costs make these changes profitable. In the lower San Joaquin Val- ley, the percentage of total digestible nutrients supplied by concentrates has increased in the past three years, to about 26 per cent. It is likely that at least part of this increase in concentrates is a re- sult of heavier rates of feeding associated with the increase in number of dry-lot operations.

Feed input-output relationship. For the purposes of this study, a simplified feed input-output relationship is adapted from previous work (table 8). Underly- ing this synthesized relationship are the following assumptions: The relationship is based on high-quality Holstein cows. Quality of milk cows and feed-conversion efficiency are considered to be uniform in both regions of the milkshed. The

Table 7. Relative Importance of Hay, Pasture, and Concentrates in Dairy Rations in Selected Producing Areas in California, Quarterly, 1957–1959

Ration	Per cent total digestible nutrients per cwt. of milk											
	1957 quarter				1958 quarter				1959 quarter			
	1	2	3	4	1	2	3	4	1	2	3	4
Metropolitan L. A.-Orange												
Alfalfa hay	65	64	64	63	63	63	63	62	62	62	62	62
Pasture	..	..	..	..	..	..	..	..	..	..	..	..
Concentrates	35	36	36	37	37	37	37	38	38	38	38	38
Southern San Joaquin												
Alfalfa hay	78	55	65	66	66	65	65	70	74	68	66	74
Pasture	..	25	10	10	8	10	10	5	..	7	8	..
Concentrates	22	20	25	24	26	25	25	25	26	25	26	26
Northern San Joaquin												
Alfalfa hay	80	50	50	66	74	37	45	68	80	44	44	72
Pasture	..	30	28	12	5	40	31	10	..	35	35	5
Concentrates	20	20	22	22	21	23	24	22	20	21	21	23

SOURCE: Bureau of Milk Stabilization (1957–1959).

range of feeding alternatives is highly simplified: the specified ration is composed solely of a concentrate mixture of 75 per cent total digestible nutrients (TDN) and alfalfa hay of 50 per cent TDN. In practice, the individual producer may be able to substitute a wide range of purchased or home-grown components, especially in the northern milkshed. Finally, the relationship should not be interpreted as an average for existing operations, but as a production relationship attainable with high-quality animals.

Number of Cows

Nearly instantaneous adjustments in output can be achieved by varying the number of cows milked, as contrasted with the slow output adjustments through higher rates of feeding or improvements in herd quality. The use of this method of output adjustment is facilitated by the large, well-organized market for replacement cattle that exists in the milkshed.

Output variation through varying intensity of plant use involves given productive facilities which are subject to a greater or lesser degree of short-run intensification in use in a rate per time-period sense. For instance, larger barns

may offer an opportunity for higher output per time period by increasing the number of milkers and milking units. However, some elements of a plant are frequently designed for a definite rate of use. For example, variations in the rate of milking may be limited by the milking equipment or by the limited capacity of the cooling system. In addition, a fixed time element enters the milking process because of the interval required for extraction. Since the feeding of concentrates is usually considered to be a part of the milking process, the minimum period required for feeding also limits upward adjustments in rate of plant use. Rates in excess of this upper limit, if maintained for a significant period, may lead to physical damage to the animals, and ultimately to reduced output and higher unit costs.

On the other hand, more cows can usually be milked in a plant by extending the number of hours of milking per day, maintaining a given rate of operation per hour. Even so, some elements of a plant are usually designed with some upper limit on total herd size in mind. Thus, corrals and feed areas may be constructed to handle a specified maximum

Table 8. Estimated Annual Feed Input-Output Relationship, Los Angeles Milkshed

Concentrate feed	Hay consumed	Estimated milk produced (3.5 per cent)	Estimated milk fat produced
	POUNDS		
0	11,950	9,400	329.0
500	11,750	10,225	357.9
1,000	11,535	10,948	383.2
1,500	11,305	11,559	404.6
2,000	11,060	12,074	422.6
2,500	10,800	12,499	437.5
3,000	10,525	12,874	450.6
3,500	10,235	13,199	462.0
4,000	9,930	13,474	471.6
4,500	9,610	13,699	479.5
5,000	9,275	13,859	485.1
5,500	8,925	13,959	488.6
6,000	8,560	14,011	490.4

SOURCE: Davidson (1960).

number of cows. Also, hours of operation may be limited because of limited tank capacity for milk storage or because of sanitation and cleanup problems.

In practice, because the various stages of the production process must be kept in harmony with each other, the rate of operation may not be varied too much. However, if milking facilities (through design flexibility or easily alterable capacity) can operate over a range of herd sizes, then output can be increased by enlarging herd size and increasing the hours of operation. As discussed above, bulk-tank capacity or corral and feeding space may place an effective limit on the herd size of a given operation at any time.

Approach to Estimation of Regional Production Costs [8]

To facilitate interregional comparisons, costs of production will be computed for four standardized operations in each region. Each operation assumes a stanchion barn with 30, 60, 90, or 120 stanchions. Equipment for each plant is chosen to reflect full use of the most advanced technology, including pipeline milking, automatic washers, and automatic feeders. Thus, the synthesized plants are not designed to be representative of existing operations in any district of the milkshed. Rather, results of the estimation procedure should be interpreted as minimum achievable cost levels with the given selection and organization of plant and equipment under specified factor cost rates.

Each alternative plant is equipped to handle a milking herd four times as large as the number of stanchions in the barn in a maximum of nine hours of operation, which establishes output capacity for single-shift milking. Output per day in excess of this capacity implies equipment changes and operation beyond the

[8] For a detailed description of methodology for synthesizing plant cost functions, see French *et al.* (1956).

nine hours available under single-shift operation.

The shape of the short-run cost functions for each plant will depend on the relationship of all cost variables on a per-cow basis to increases in the number of cows milked. If all variable cost items are constant or decrease on a unit basis as output increases, then the short-run cost curves can be expected to decline continuously to capacity output, because overhead charges associated with the fixed plant are spread over more units. The long-run relationship of unit costs to volume produced can be determined by comparing unit costs for plants of different sizes.

In initial development of production costs, cost rates for the southern milkshed are chosen to represent the southeastern Los Angeles-Orange producing district. Because of the wide variation in cost conditions in other districts of this region, the results are modified later to apply to other producing districts. The greater homogeneity of factor cost rates in the northern milkshed makes it possible to derive production costs considered typical for the whole region.

Labor Requirements

In dry-lot milk production, possible choices between alternative combinations of plant and equipment permit substitution between capital and labor in the production process. The following estimate of labor requirements recognizes three factors: choice of technology, size of milking barn, and number of cows milked. The milking process is defined to include preparation, movement of animals, feeding, and cleaning of barn and equipment as well as the extraction of milk.

For all plants considered, choice of equipment is designed for maximum efficiency in labor use. Labor requirements for milking are synthesized on the basis of one milking per cow for alternative barn and herd sizes (table 9). Total

[38]

Table 9. Estimated Milking Labor Requirements by Barn and Herd Sizes, Per Milking

Number of cows milked	30-stanchion barn	60-stanchion barn	90-stanchion barn	120-stanchion barn
	man hours			
30	1.4	..	..	..
60	2.8	4.2	..	..
90	4.1	..	5.4	..
120	5.2	6.6	..	7.0
150	..	8.6	..	..
180	..	9.1	9.0	9.5
210	..	10.3	..	..
225	..	..	10.8	..
240	..	11.6	..	12.0
270	..	..	12.6	..
300	..	..	..	14.5
315	..	..	14.3	..
360	..	..	16.2	17.0
420	..	..	..	19.5
480	..	..	..	22.0

SOURCE: Davidson (1960).

daily milking labor requirements can be obtained by doubling the estimates to represent both milking periods in a single-shift operation.

Labor requirements per cow for each barn size decline as herd size increases. At constant wage rates, this implies decreasing labor costs per unit of output with increasing herd size. In practice, because lumpiness of the labor input may require that milking labor be employed in full man-day units, this volume-labor cost relationship may be obscured. It is assumed that the producer, in the long run, will find it possible to synchronize labor requirements with available man-hours, so that all labor is used fully.

Note: The labor requirements presented include only the milking operation, and do not explicitly consider outside labor requirements, such as feeding hay, cleaning corrals, and herd management. Factors affecting efficiency of labor in outside work include arrangement of corrals and alley, feeding facilities, and type and quantity of machinery and equipment. The amount of this type of labor varies widely in existing opera-

tions (Phelps, 1960). Additional labor requirements are estimated to be one minute per day per cow.

PRODUCTION COSTS FOR THE LOS ANGELES MILKSHED

The preceding section dealt with labor input requirements for alternative plants and herd sizes. An earlier section established a feed input-output relationship attainable under improved breeding. By introducing regional factor costs, production costs can be generated for the synthesized plants for each region of the milkshed, and comparisons drawn to indicate optimum location on the basis of production costs.

Plant Investments and Overhead Costs

While investments per cow at plant capacity decline at a decreasing rate with barn size in both regions, investment levels are more than twice as high in the southern milkshed (table 10). Area differences in investments primarily reflect differences in land values and construction costs.

Table 10. Investments by Barn Size and Location, Los Angeles Milkshed (1959 price level)

Investment category	30-stanchion barn	60-stanchion barn	90-stanchion barn	120-stanchion barn
	dollars			
Southern milkshed				
Milking plant*......................	10,260	17,270	24,210	29,600
Milking equipment†..................	10,280	15,290	19,150	22,975
Other buildings and equipment‡.......	24,500	33,240	40,125	46,145
Total plant and equipment........	45,040	65,800	83,485	98,720
Land§..............................	36,000	72,000	108,000	144,000
Total investment.................	81,040	137,800	191,485	242,720
Investment per cow at plant capacity .	675	574	532	506
Northern milkshed				
Milking plant*......................	8,770	14,800	20,180	24,670
Milking equipment†..................	10,280	15,290	19,150	22,975
Other buildings and equipment‡.......	17,400	23,740	28,660	32,960
Total plant and equipment........	36,450	53,830	67,990	80,605
Land§..............................	6,000	12,000	18,000	24,000
Total investment.................	42,450	65,830	85,990	104,605
Investment per cow at plant capacity .	354	274	239	218

* Milking plant includes a milking barn, milk house, and bulk concentrate tank.
† Equipment includes pipelines and other facilities to provide capacity in a single shift for a milking herd four times the number of stanchions.
‡ Designed to handle a herd 25 per cent larger than the number of cows milked. Includes hay barns, water and waste disposal system, corrals and fences, concrete and asphalt paving, and miscellaneous buildings.
§ Land requirements estimated at 20 milking cows per acre. Costs estimated at $6,000 and $11,000 per acre in the southern and northern regions, respectively.
Source: Adapted from Davidson (1960).

Costs associated with the fixed plant are defined as overhead costs; they do not vary with short-term variations in rate of output. Costs classified as fixed when no plant changes are planned include interest, depreciation, taxes, and insurance on buildings and equipment. Some charges for repairs and maintenance, utilities, and supplies are also incurred if any regular production is undertaken and are included in the fixed-cost category.

Though theoretically unrelated to short-period output decisions, overhead costs are significant in two ways for the present study. First, since they are fixed in total, overhead costs necessarily decline on a unit basis as short-run output is increased. Thus, they are absorbed best at capacity operations. Second, their presence sharpens a producer's incentive to locate where less capital investment is required per unit of output, other things being equal.

Many fixed charges are unrelated to any chronological period but take on the nature of annual commitments because of the institutional nature of their determination. This is usually true of interest charges when they are contractual rather than inputed—reflecting external financing of investments in plant—and of insurance and taxes. All are estimated as annual costs and expressed as a constant with changes in herd size (table 11).

Table 11. Estimated Annual Overhead Costs by Barn Size and Location

Item	30-stanchion barn	60-stanchion barn	90-stanchion barn	120-stanchion barn
	dollars			
Southern milkshed				
Interest*................................	3,511.20	6,294.00	8,894.50	10,024.50
Depreciation†...........................	2,007.40	2,918.00	3,671.80	4,342.05
Repairs and maintenance‡................	450.40	658.00	834.85	987.20
Taxes and insurance§....................	2,403.10	4,134.00	5,744.55	7,281.60
Other‖..................................	150.00	300.00	450.00	600.00
Total...............................	8,522.10	14,304.00	19,685.70	23,235.35
Northern milkshed				
Interest*................................	1,753.50	2,334.90	3,119.70	3,858.20
Depreciation†...........................	1,678.70	2,463.90	3,092.30	3,666.75
Repairs and maintenance‡................	364.50	538.30	679.90	806.05
Taxes and insurance§....................	849.00	1,316.60	1,719.80	2,092.10
Other‖..................................	150.00	300.00	450.00	600.00
Total...............................	4,795.70	6,953.70	9,061.70	11,023.10

* Computed at 6 per cent on average investment, which is assumed to be one-half of the initial investment in plant and equipment plus the investment in land.
† Milking plant is depreciated at 3 per cent of original cost per year, milking equipment at 7 per cent per year, and other buildings and equipment at 4 per cent.
‡ Computed at 1 per cent of investment in plant and equipment.
§ Estimated at 3 per cent and 2 per cent of total investment, southern and northern milksheds, respectively.
‖ Includes fixed portion of supplies and utilities computed at $5.00 per stanchion.
SOURCE: Adapted from Davidson (1960).

Direct Production Costs

About 85 per cent of total production costs of market milk can be considered variable on a per-cow basis; feed alone usually accounts for at least 50 per cent of total production costs, and labor costs are usually about 20 per cent of the total. Also discussed are replacement costs, and other direct costs such as cow taxes, breeding and veterinary charges, and parts of utilities and supplies.

Feed costs. Given the basic input-output relationship, and prices, feed costs per unit of output depend on the rate of feeding and the proportions in which concentrates and forage components are combined in the ration. Optimum feeding levels and combinations of components can be expected to vary with relative prices of the feedstuffs, and with prices received in the sale of the product. Production per cow is in turn affected by these factors, since heavier rates of feeding and/or higher proportions of concen-trates would be expected to increase production per cow, all other things being equal.

To simplify determination of production costs, rates of feeding and proportions of concentrates and roughages in the rations are projected for each region. Production per cow is determined according to the feed input-output relationship. Feed costs per hundredweight of milk are derived by applying regional costs of the ration components.

Since the southern milkshed is a feed-deficit area, it is often concluded that all feed costs are higher. Hay prices are higher, mostly because hay needs to be transported into the southern milkshed from surplus producing areas such as the San Joaquin Valley. But prices for concentrates are significantly lower than in the northern milkshed (table 12) probably due to nearness of ocean ports, where ingredients from foreign and domestic sources can be received, large-volume deliveries with short hauls, and intense com-

Table 12. Costs of Hay and Concentrates by Area, 1957–1959
(dollars per ton, f.o.b. dairy)

Year	Quarter	Metro. L. A.-Orange		Southern San Joaquin	
		Alfalfa	Concentrate	Alfalfa	Concentrate
1957..........................	1	35.00	65.00	31.00	70.00
	2	32.00	62.00	24.00	68.00
	3	29.00	60.00	23.25	64.50
	4	33.00	57.00	28.00	63.00
1958..........................	1	32.00	57.00	27.00	62.00
	2	32.40	57.00	28.00	62.00
	3	31.00	59.00	24.00	62.00
	4	31.00	61.50	26.00	64.00
1959..........................	1	34.00	66.25	27.00	70.00
	2	33.00	64.50	27.00	67.50
	3	32.00	63.00	28.00	65.00
	4	34.25	63.00	31.33	65.50

petition among feed dealers (McCorkle, 1960, p. 7).

Since large-scale producers in the southern milkshed can be expected to continue to import large quantities of hay from other areas in the future, hay price differentials will continue to favor producers in the northern milkshed. Respective prices of $35.00 and $27.00 per ton are assumed, the differential reflecting approximately the current cost of transporting hay into the southern milkshed from the northern region. Widespread use of pelleting or wafering techniques may reduce this differential unless savings in transportation, waste and shrinkage are offset by pelleting costs.

For concentrates, prices should continue to favor producers in the southern milkshed, but by a decreasing relative margin. As production in the southern milkshed continues to be dispersed from the Los Angeles metropolitan area, the increased hauls can be expected to increase prices at the dairy. At the same time, continued adoption by feed companies in the northern milkshed of the large-volume processing and bulk-hauling techniques developed in the southern milkshed should contribute to a greater equality of relative prices. The respective prices assumed in this study are $62.00 and $65.00 per ton.

The northern milkshed has an absolute advantage in feed costs per unit of milk produced at all levels of feeding and feed costs considered relevant (table 13). The relative advantage of the northern region declines, however, as the proportion of concentrates in the ration increases, reflecting the underlying regional price patterns for the ration components.

It now remains to specify regional feeding rates, to which will correspond feed costs per unit of output. This is an optimizing problem of great importance in itself. Since feeding rates that would minimize costs for any level of output depend on the price of the product as well as the input-output relation and feed prices, their derivation was not attempted here. It is assumed that the current yearly level of 4,500 pounds of concentrate per cow will be approximately maintained in the southern milkshed. together with a consumption of 9,610 pounds of hay. Corresponding milk production is 13,699 pounds. For the northern milkshed, 3,000 pounds of concentrates allows for an upward adjustment in the current level of feeding, and 10,525 pounds of

hay are assumed. This combination results in 12,874 pounds of milk. This specification of constant feeding rates greatly facilitates the computation and interregional comparison of production costs, but the validity of the results rests in some measure on the accuracy of the projected feeding and production rates.

Labor costs. Labor costs are projected using rates of $2.25 per hour in the southern milkshed and $2.00 per hour in the northern region and previously developed physical labor input requirements. The assumed wage rates reflect a smaller interregional differential than exists currently. Since the existing differential reflects both productivity and opportunity cost factors, and since the labor requirements synthesized earlier implicitly assume equal productivity in the two regions, some equalization of wage rates between the regions can be expected, although the opportunity cost factor is likely to sustain a reduced differential for an indefinite period in the future.

Replacement costs. Replacement costs arise, cows need to be replaced with new stock after a certain period. Replacement cost per cow is the cost of a new animal less the salvage value of the cow replaced, adjusted for death loss, and spread over expected years of use. The replacement rate and buying and selling prices are major factors determining replacement cost on a per-cow basis. The optimum replacement rate is essentially an investment problem (Faris, 1960, pp. 755–66). Based on an assumed replacement rate of 33 per cent and a purchase price of $300, salvage value of $150, and adjustments for death losses and calves sold, corresponding replacement costs per cow are $45 per year.

The assumed replacement rate is considerably higher than that currently prevailing in the northern region. However, as dry-lot operations spread to the northern milkshed, associated heavier culling rates and higher prices where replacements are purchased are expected to justify the replacement cost assumed.

Other direct costs. This category includes cow taxes, breeding charges, veterinary expenses, part of utilities and supplies, association dues, and similar miscellaneous items—all variable with herd size. Tax rates on cows are estimated at $10 per head per year in the southern region and $3 in the northern. The remaining categories of direct costs are assumed to total $22 per cow per year in both regions.

Plant Cost Curves and Long-run Production Costs

The previous analysis has been con-

Table 13. Alternative Feeding Rates and Costs per Hundredweight of Milk, Northern and Southern Milksheds

Concentrates fed	Hay consumed	Milk produced	Feed costs	
			Southern milkshed	Northern milkshed
pounds			*dollars per cwt.*	
2,000...	11,060	12,074	2.12	1.77
2,500...	10,800	12,499	2.13	1.82
3,000...	10,525	12,874	2.15	1.85
3,500...	10,235	13,199	2.18	1.91
4,000...	9,930	13,474	2.21	1.96
4,500...	9,610	13,699	2.25	2.01
5,000...	9,275	13,859	2.28	2.07

Source: Basic data taken from tables 9 and 13.

[43]

cerned with estimating cost rates for fixed and variable factors for given barn sizes, when output is varied by varying the number of cows milked. This information also provides a basis for investigating the long-run relationships of costs and output in the milkshed.

For each specified barn size and associated plant and equipment, short-run curves can be derived showing the response of unit costs to volume. These curves are expected to decline with volume increases until capacity is reached, where capacity is the level of output associated with a number of milking cows four times as large as the number of stanchions for each alternative barn size.

From these individual plant curves the economies-of-scale curve or long-run-average-cost curve can be approximated for the two producing regions. The latter curve indicates the size of plant that offers minimal unit costs for each level of output. Its shape in relation to volume indicates to what extent larger plants, offering greater capacity, can realize as low or lower unit costs than smaller plants, under the same restrictions with respect to hours of operation per day.

Average costs of production by barn and herd sizes and region are given in table 14. (For details see Appendix B.) From these volume-cost data are derived

approximations to the long-run average cost curves for each region (figure 9). Interregional differences are reflected in levels of the curves rather than shapes, so the same conclusions with respect to the presence of economies of scale are applicable to both.

For the range of barn sizes considered, larger plants, when operated at design capacity, offer the possibility of achieving average costs as low as for any other plant size, and lower than the smallest plant included in the analysis. On the other hand, higher costs per hundredweight of milk would occur for any large plant operated at less than the capacity level of the next smaller plant. Though economies of scale are shown to be moderate in the range of plant sizes considered, there is no indication of the presence of diseconomies that might cause the long-run cost curves to turn up. Thus, for the range of output considered, approximately constant long-run average costs of production are indicated after initial economies are exploited.

Regional Production Cost Differentials

Average production costs for all plant and herd sizes are lower in the northern milkshed than in the southern. One important source of this differential lies in

Table 14. Average Costs of Production, by Barn and Herd Sizes and Region

Number of cows milked	30-stanchion barn		60-stanchion barn		90-stanchion barn		120-stanchion barn	
	Southern milkshed	Northern milkshed	Southern milkshed	Northern milkshed	Southern milkshed	Northern milkshed	Southern milkshed	Northern milkshed
	dollars per hundredweight, 3.5 per cent milk							
30............	5.59	4.30						
60............	4.52	3.66	5.46	4.15				
90............	4.10	3.37	....	....	5.25	3.97		
120............	3.96	3.31	4.40	3.52	....	....	5.04	3.88
180............	....	....	4.05	3.31	4.34	3.47		
240............	....	....	3.88	3.22	....	....	4.24	3.44
270............	....	....	....	....	4.03	3.30		
360............	....	....	....	....	3.88	3.22	3.98	3.33
480............	....	....	....	....	....	....	3.87	3.21
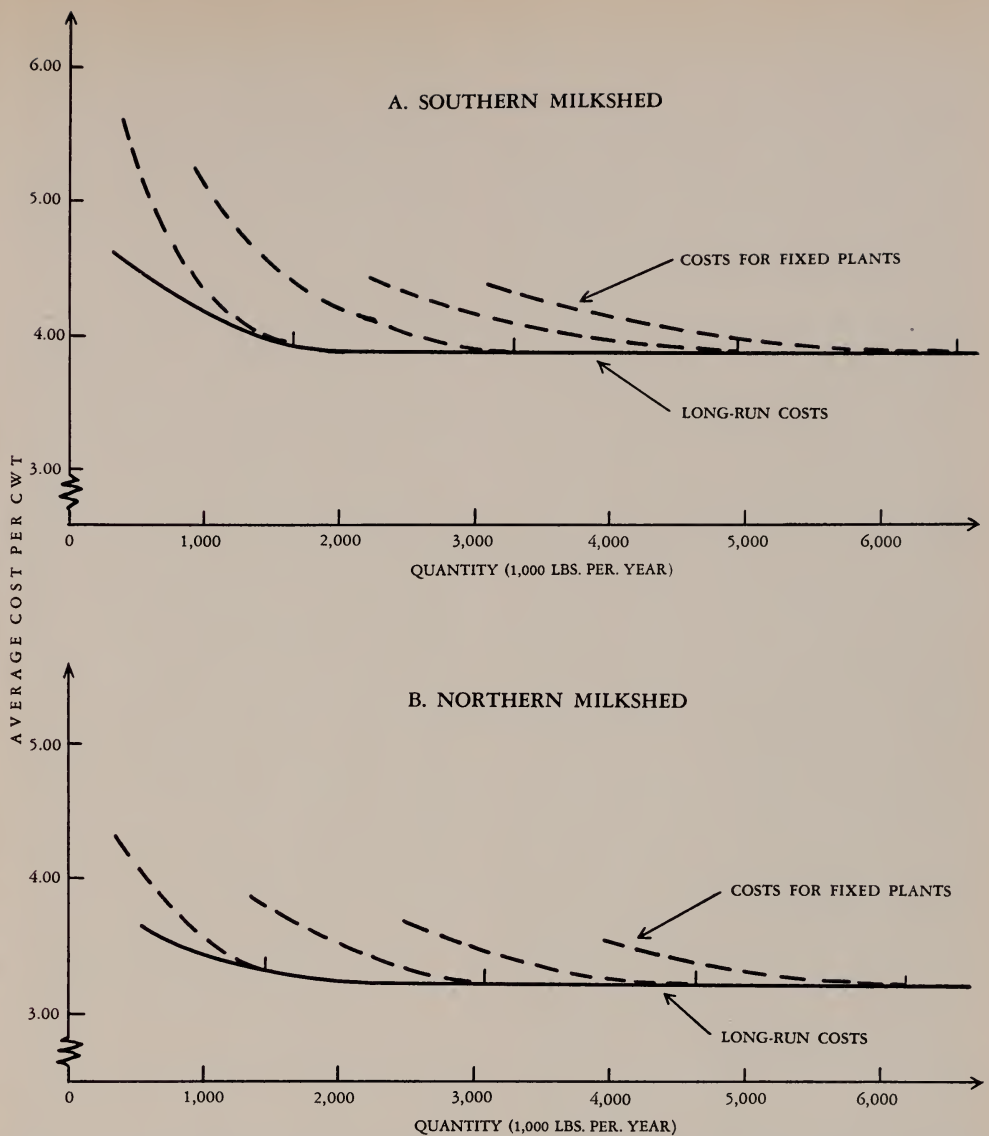
Figure 9. Long-run production costs by region, Los Angeles milkshed. (Source: Appendix B, Tables 1–4)

the fixed costs, since investment require-ments for identical plant organization and equipment are only about half as large in the northern milkshed as in the southern district, reflecting construction cost and levels of land values. In addition, unit costs for feed and labor are lower in the northern region.

The relative advantage of the northern milkshed is greatest at lower volumes for each plant size, and least for capacity operations. The variation is from about 75 to 85 per cent of costs in the southern region for comparable northern opera-tions. This primarily reflects the fact that higher fixed costs in the southern milkshed are best absorbed at capacity operations.

A brief summary of some of the major assumptions underlying the synthesis of these cost data aids in interpreting the results. A basic feed input-output relationship is assumed, representing attainable feed conversion with high-quality stock. This relationship is applied in both regions, which implicitly assumes that cow productivity is the same in both regions. Thus, environmental conditions are not reflected in interregional productivity, and differences in output per cow are explained solely by feeding practices. In reality, output per cow decreases in periods of prolonged high summer temperatures in the northern region. Decreased production per cow, as well as any management practices followed in efforts to mitigate the decline, would result in some increase in costs per unit of output, and perhaps modify the conclusions reached above with respect to interregional production cost differentials.

All output increases are obtained by increasing the number of cows milked, which implies that marginal feed costs for output increments are constant. Arbitrary feeding rates, considering the further spread of drylot production to the northern milkshed and regional differences in prices for concentrates and hay, are used to establish production per cow.

Finally, capacity for each alternative plant is limited to a milking herd four times as large as the number of stanchions in the barn. This is assumed to represent plant capacity for single-shift milking, with a maximum of 9 hours of operation per day. Output increases beyond the specified herd size would require organizational and equipment changes and extension of hours of operation to double-shift milking.

TRANSPORT COSTS

Before conclusions can be drawn about least-cost location, it is necessary to determine to what extent regional production cost differentials are offset by costs of transporting the product.

Again, the problem is one of estimating "efficient" levels of costs for milk transport by production location under technological conditions expected to prevail. Transport costs considered include those associated with the movement of milk from the alternative supply regions until it is received at a Los Angeles plant.

Bulk transport of milk from farm to plant prevails in all producing districts in this milkshed, and no important changes in this system of transport are anticipated. Factors that influence transport cost rates include distance from farm to plant, and production density. Since the fixed time elements involved in loading and unloading do not vary with farm-to-plant distances, transport costs are expected to increase with distance at a decreasing rate. The density factor reflects both the number of producers in a given area and the volume per producer; together, these determine the distance and number of stops necessary for full loading of a tank truck. Daily and seasonal stability of production in a given area affects the degree of utilization of equipment and corresponding cost rates.

The current rate for transport of milk by contract carriers to Los Angeles plants from the southeastern Los Angeles-Orange producing district is $.15 per hundredweight. This district is geographically compact and includes a large number of high-volume producers. Moreover, relatively short farm-to-plant hauls, which increase the importance of loading and unloading time relative to distance traveled, lead to expectations of only modest savings in cost by a reorganization of routes designed to minimize total distance traveled.[9] The current rate is therefore used in this analysis.

The northern milkshed presents a more complicated problem. Milk to be shipped to Los Angeles from the northern milkshed is first received at local plants

[9] Interview with Mr. Joseph Perumean, President, California Milk Transport.

and then reshipped to Los Angeles plants. Thus, transport charges are involved both for local assembly—currently $.15 per hundredweight—and for interplant shipments between regions — currently $.45 per hundredweight (Bureau of Milk Stabilization, 1959).

If direct shipments were adopted, whereby milk would move from producers' dairies to Los Angeles plants with no intervening stops at local plants, it is likely that some economies could be obtained over current cost levels, reflecting the elimination of hauls to local plants north of producers' dairies followed by reshipments to the south, as well as handling at country plants. At the same time, direct shipments may well require organizational and equipment changes that could partially offset potential savings over current costs (Sosnick and Tinley, 1960). For present purposes, the transport cost adopted is $.60 per hundredweight for shipments from the northern milkshed to Los Angeles plants, though this probably overstates the locational disadvantage of the northern milkshed in terms of product transport costs, under a minimum-cost organization of transport.

LEAST-COST LOCATION AND REGIONAL LOCATIONAL ADVANTAGES

By adusting unit costs of production to reflect product transport costs by region, interregional comparisons can be made on a basis of total costs f.o.b. Los Angeles plants. Since regional transport costs are specified as constant rates per hundredweight of milk, their impact on regional cost curves is to elevate them by the amount of the unit cost of transport. For capacity operations with larger plants, relative combined costs in the northern milkshed increase from 83 to about 95 per cent of combined costs in the southern milkshed. Thus, while the inclusion of transport costs on the product does not eliminate the absolute cost advantage of the northern region, it does reduce its

relative advantage by more than two-thirds.

Recognition of regional differences in plant utilization provides an additional significant comparison. For example, a 60-stanchion barn in the southern milkshed, when used for a maximum herd size of 240 cows, results in average costs of $3.88 per hundredweight, or combined unit costs of $4.03. If a similar size of barn is used in the northern milkshed for a milking herd of only 120 cows, then combined unit costs would be $4.12, or 102 per cent of combined unit costs in the southern region. This indicates that realized regional cost advantages also depend on the degree to which plants are used at capacity rates.

To the extent that regional cost differentials reflect higher fixed costs in the southern milkshed, extending hours of operation to double-shift milking offers a possibility of reducing the gap. In many cases, this would require only a relatively small additional investment in terms of a larger bulk tank or more corral space, and may permit overhead costs to be reduced to as little as one-half of what they would be with single-shift operation. Double-shift milking cannot be expected to overcome regional feed and labor cost differentials, however.

The general conclusion thus far is that advantages of producing close to the market, initially arising through perishability and high product transport costs, have tended to work themselves out and disappear. Adjustments of local producers to rising factor costs have included the development of specialized dry-lot operations, dependence on imported feeds, and increasing scale of operations to attain high labor efficiency and low unit costs. Currently, the adoption of these same productive techniques in the northern milkshed makes it possible for milk to be produced and transported to Los Angeles plants at a lower cost than can be achieved in the original supply area.

Thus, regional cost relationships indicate that shifts in market supply patterns in favor of the northern milkshed should be forthcoming, with producers in the southern milkshed contributing a constantly decreasing share of total market requirements. However, since adjustments in industry patterns must reflect decisions of individual producers with respect to location and level of output, as well as decisions of distributors with respect to supply and utilization patterns, demand factors are involved as well as cost considerations. Hence, it is necessary to place firm choices in a maximum-profit framework, where revenue conditions at the producer level are explicitly recognized.

IV. PRODUCER PRICES, PROCUREMENT PRACTICES, AND LOCATION ADJUSTMENTS

PRICES PAID TO PRODUCERS in the supply areas of the Los Angeles milkshed are not freely competitive but are affected importantly by the institutional pricing structure and the contracts that exist between producers and distributors. For these reasons performance of the market with respect to the determination of producer prices may diverge substantially from the competitive model and become an important element in firm and regional supply adjustments. The major hypothesis of this section is that supply adjustments in the milkshed are strongly influenced by producer price outcomes, reflecting the nature of price determination and market utilization patterns. Testing this hypothesis will suggest the role of the revenue factor in future adjustments in sources of supply.

DEMAND AND PRICES FOR MARKET MILK AT THE PRODUCER LEVEL

The term "derived demand" for commodities in the buying market at the farm level suggests that producer-level demand is obtained by subtracting average costs of marketing from the schedule of consumers' demand. This concept suggests correctly that ultimate demand by consumers is a basic determinant of producer-level demand, and also that marketing costs must be considered in translating consumer demand back to the farm level. These costs represent an important component of the retail price of most farm commodities; fluid milk is no exception, marketing charges usually representing half of the retail store price of a quart of milk.

Farm-level demand for milk represents the aggregation of a number of quite separate consumer demands. Important uses for market milk include fluid skim milk, flavored drinks, half-and-half, sour cream, fluid milk, and cream. In addition, substantial quantities of market milk are used—although not required—for cottage cheese, frozen products, and buttermilk. Statistical studies have shown that price elasticity for fluid milk and cream is quite low—somewhat lower than for ice cream and cheese. This implies that the price elasticities of demand for milk at the farm level could vary significantly depending upon the disposition of the milk of a producer, group of producers, or area.

Also, buyers do not typically play a passive role in the farm-level market for milk. Continuous production and the

perishability of milk make it impossible for distributors to bid for their daily needs in an open market, or for producers to sell their daily production there. This gives rise to relatively stable buying and selling relationships between producers and distributors. At the same time, buyers can be expected to exercise a measure of control over their buying policies and purchase terms, within the limits imposed by market power relations. Quantity, quality, and stability are all features of a raw-product supply that create interdependence between procurement problems of distributors and production practices of producers.

Equally important is the fact that demand cannot be fully expressed in a single static net price-quantity relation facing producers at alternative locations. Variation within and between supply areas, because of the complex institutional organization of the market, makes attainment of such precision practically impossible. The income position of an individual producer through time depends importantly on such factors as past level and stability of production, product quality, plant transport and handling deductions, and technical assistance by plant fieldmen. All these factors, plus future expectations about contract provisions, enter into the producer's determination of his present output.

Producer-Distributor Contracts

The California milk control program requires all stabilization and marketing plans to contain a provision that distributors shall not purchase more than 200 gallons of market milk monthly from any producer or association of producers without a prior contract. Required provisions of the contract include:
- Amount of fluid milk to be purchased for any period
- Quantity of such milk to be paid for as Class 1
- Price to be paid for all milk received

- Date and method of payment
- Charges for transport if hauled by the distributors
- Proviso to the effect that the producer shall not be obligated to deliver milk to be paid for at, or less than, the minimum price for Class 3 milk

The contract amount, usually called the "quota," or "base," may be specified in terms of volume of milk fat and skim milk components separately. If the contract base is stated in terms of milk fat only, the quota for skim milk is specified to be that amount contained in sufficient whole milk to account for the milk fat quota, on the basis of the average monthly test of all milk received from the producer involved. Similarly, the quantity of milk to be paid for as Class 1, usually called the "Class 1 guarantee," may be stated separately for milk fat and skim milk, or for milk fat only, in the above manner.

The code further provides that producer contracts may contain other provisions as long as they are not in conflict with the control legislation. Other provisions found in some contracts include:
- a requirement that all milk must meet the standards for Grade A milk prescribed by the State of California, all local authorities, and those established by the distributor as to flavor, odor, sediment, bacterial count, temperature, solids-not-fat, and foreign materials
- proportional reduction in Class 1 guarantees if deliveries for a given month are less than the contract amount
- reduction in the contract amount if a producer's actual deliveries for a specified period are less than the contract amount
- purchase of all milk produced by the producer's herd
- termination of the contract in event of a "substantial change" in operation of the milk control law
- mutual permission for the producer to check weighing and testing, and for

the distributor to inspect premises and take samples

• diversion of excess milk directly to manufacturing plant, instead of going to the fluid milk plant first to become part of the plant payment pool

• prohibition of producer membership in or affiliation with any producer organization engaged in handling, sale, or marketing of milk and/or with authority to negotiate terms of sale of producers' milk

• specification that the contract is not assignable, and written permission of the distributor is required for its transfer

Determination of Net Producer Prices

The income position of the producer must be stated in terms of *net* product prices which are quite different from, though related to, minimum f.o.b. plant class prices. *Net prices* are determined both by the percentage of total production of milk paid for in the various classes and by the deductions that distributors are authorized to make.

The type of pooling system adopted in California markets affects producer prices directly. A pooling system is a necessary adjunct to any classified pricing program. It denotes an averaging process on some prearranged basis for distributing the proceeds from sales of milk to dealers at different prices.

Except for producer associations, which are free to determine their own pooling arrangements, the system in California is basically individual plant pooling operated within the framework of producer-distributor contracts. Essentially, each producer participates in three separate "pools." Milk delivered to a plant within the Class 1 guarantee goes into the first pool. All of this milk (or milk fat and skim milk if contracted for and priced separately) is paid for at Class 1 prices. The third pool is composed of all milk shipped to a given plant that is in excess of the contractual

base of each individual shipper. This pool is made up of milk over base with respect to the total contractual amount, not the Class 1 guarantee. Class 2 and 3 utilization of the plant is first applied to milk in the third pool, often called the "surplus" pool. The second, or intermediate, pool is made up of producer shipments to a given plant that are in excess of the Class 1 guarantee but within the contract base. To this second pool, and subsequently the third, is applied any Class 1 utilization of the plant not accounted for in the first pool. Thus, for shipments in excess of Class 1 guarantees, payment is on a usage basis, except that no overbase production is paid for at Class 1 until the plant's Class 1 utilization exceeds aggregate within-quota receipts.

Minimum class prices for use in determining producer payments are established by the control authority and specified in the applicable stabilization and marketing plan, as determined by area of use of a producer's milk rather than area of origin. It is widely recognized that standards contained in the control legislation for setting minimum prices are far from specific; they are statements of general intent, providing only a broad frame of reference and requiring liberal administrative discretion in their application. (Clarke, 1955, pp. 63–75). A specific provision in the legislation requires that prices established for surplus uses (Class 2 and Class 3), less authorized deductions, must not be lower than f.o.b. ranch prices being paid for manufacturing milk. In the past, this provision has been applied in such a way that Class 2 and Class 3 prices were identical in each marketing area and based directly on manufacturing milk prices. In the summer of 1959, minimum prices for Class 2 milk in 21 marketing areas, including all San Joaquin Valley counties, were increased by $.002 per pound milk fat and $.20 per hundredweight skim milk above the established minimum prices for Class 3 use. The lat-

ter continues to be directly related to prices for manufacturing milk.

Class prices are established on an f.o.b.-plant basis. The law further requires that the stabilization and marketing plans establish the maximum deductions that can be charged for transport when the distributor transports milk, or contracts for its transport, from the producer's dairy. Maximum deductions for other services performed by the distributor are also required to be established, including charges for receiving, refrigerating, separating, and shipping milk or cream from a country plant, and installing and/or maintaining holding tanks at the producer's dairy.

An example may clarify determination of blend prices to producers under the combined individual plant pool-contract system. Suppose producer A has a contract base of 3,000 gallons of milk per month—the normal accounting period—and a Class 1 guarantee of 2,700 gallons per month. Producer B has a contract for 2,000 gallons monthly but his Class 1 guarantee is only 1,000 gallons. Each of the two producers ships to the same plant; shipment during the last month is 4,000 gallons of milk by each. The milk shipped within their respective Class 1 guarantees—2,700 gallons for A and 1,000 gallons for B—is placed in the plant's first pool. This milk is always paid for at Class 1 prices, regardless of the plant's use. Shipments that are "over-contract"—1,000 gallons for A and 2,000 gallons for B—are placed in the plant's third pool. Surplus use by the plant is allocated first to this pool. Milk shipped within base, but in excess of the Class 1 guarantee, goes into the second pool— 300 gallons for A and 1,000 gallons for B. Class 1 use by the plant that is not accounted for in the first pool is allocated, in turn, to the second and third. When the entire Class 1 use by the plant has been allocated, the remainder of the milk is paid for at surplus prices.

The example shows that the blend price for each producer depends on use by the plant to which he ships as well as the provisions of his own contract and his total shipments. The Class 1 guarantee establishes the lower limit to the amount that must be paid for as Class 1, even though Class 1 use by the plant falls short of its aggregate guarantees. If this were the case for the example above, A would have 2,700 gallons and B 1,000 gallons paid for at Class 1. Remaining shipments of both—1,300 gallons for A and 2,000 gallons for B— would be paid for at Class 2 and 3 prices. At what may be regarded as the other observable extreme, total Class 1 use by the plant may equal or exceed the aggregate contract base, i.e., the combined first and second pools. In this case, A would have at least 3,000 gallons paid for at Class 1 and not more than 1,000 at surplus prices; B would have 2,000 gallons Class 1 and 2,000 gallons surplus.

A great variety of situations are possible, especially since milk fat and skim milk may be priced separately, Class 2 and Class 3 price may not coincide, and various levels of base and shipments exist. The above example, however, illustrates the method of pricing milk to producers, and the factors that affect blend prices; namely, Class 1 guarantee, contract base, amount shipped, and plant utilization.

The determination of the blend prices to an individual producer is shown graphically in figure 10. Assume that Class 2 and 3 prices are identical, and that the producer receives the Class 1 price, P_1, only on the minimum guaranteed amount, Q_1. For this situation, the average revenue curve relevant to the individual producer is P_1P. It is horizontal up to the guaranteed quantity, kinked downward at that point, and declines asymptotically to the price level for surplus uses, P_{2-3}. In turn, if it is assumed that the producer received the

minimum Class 1 price for the entire contract amount, Q_c, then P_1P' is the relevant average revenue curve. Here, the kink occurs at Q_c and the curve again declines asymptotically to the P_{2-3} level.

The average revenue structure for the individual producer will always be kinked downward at the quantity paid for at Class 1. We have seen that this amount depends on total Class 1 use by the plant as well as the Class 1 guarantee and contract base for the individual producer. Thus, the expected revenue structure depends on the producer's expectations as to the *total* amount of milk for which he will be paid Class 1 prices in addition to his decision as to the total quantity to be produced. Assume that the producer ships the amount of his contract, Q_c, and expects to receive Class 1 only on the guaranteed amount, Q_1 (figure 10). He receives a blend price of P_b. What if he subsequently is paid Class 1 on a larger amount, Q_1'? The effect is to raise the blend prices from P_b to P_a, the latter determined with reference to the revenue curve P_1P'' and the quantity Q_c. Shifts in expected revenue structures, as a result of changing expectations about the amount of milk for which the Class 1 price will be paid, are termed *horizontal* revenue shifts.

The above discussion considers only the determination of *blend* prices. An additional step is necessary to arrive at *net* producer prices, which cannot exceed but may be less than blend prices. Net producer prices equal blend prices less deductions that distributors are authorized to make for transport and handling services provided. The effect of these deductions is to shift downward the net average revenue structure of the producer. If the deduction applies to the total quantity of milk shipped, as is the case for farm-to-plant transport charges, then the entire average revenue curve shifts downward and net price is below the blend price by the amount of the deduction. If the deduction applies to less than the total amount shipped—for
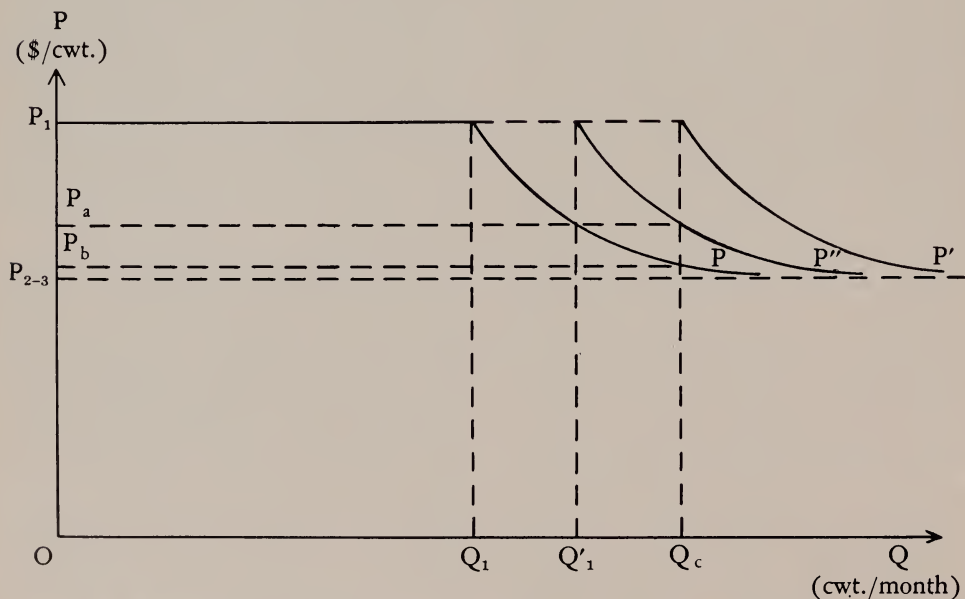

Figure 10. Determination of blend prices for a producer under California classified pricing, contracts, plant-pooling, and f.o.b. plant prices.

[52]

example, the quantity paid for as Class 1—then only the upper part of the revenue curve is affected, and the net price is reduced below the blend price by less than the unit amount of the deduction. Shifts in expected net revenue structures due to deductions for distributor services are termed *vertical* revenue shifts.

The stability of producer revenue structures clearly depends on plant use and class prices. The policy has been that minimum class prices established are lower in the spring and summer (March–August) than in the fall and winter (September–December), reflecting seasonal movements in feed costs. All other factors being constant, this policy gives rise to corresponding vertical shifts in revenue structures. Some plants experience definite seasonal patterns in amount of Class 1 use, which are transmitted to their shippers as horizontal shifts in revenue structures. In addition, some unexpected changes in class usage may occur which result in realized blend prices which are different from the expected prices.

Throughout, reference has been made to *average revenue structure* rather than to *demand structure*. In a static situation, these are identical, and show price-quantity combinations realizable by the selling firm. The dynamic aspects of the relations between buyers and sellers in the price-making process being described are such, however, that minimum and/or maximum limits may be placed on the amount of milk a firm can produce in a given period without jeopardizing its future market position. The effect of this may be to void certain portions of the average revenue curve when viewed by a producer as a demand curve for the purpose of realistically choosing the optimum level of output over time.

In the case of producer cooperatives, established minimum class prices apply to sales of the cooperative to its customers, and each association is permitted to formulate its own system for allocating revenues to individual producer-members. Not unexpectedly, cooperative groups exhibit many of the characteristics discussed above, sharing sales proceeds on the basis of established quotas and differential prices for within-quota and over-quota shipments by producers.

Interregional Differences in Net Producer Prices

Average prices received by producers in the southern milkshed consistently exceed average prices received by producers in the northern milkshed by more than the additional transport costs. Furthermore, the gap between the observed price differentials and the "efficient" differential has tended to increase in recent months (table 15).

The "efficient" differential is the additional cost of transporting milk to Los Angeles plants from the northern milkshed above the farm-to-plant transportation costs in the southern milkshed— about $.45 per hundredweight of milk. Referring again to the economic model developed, equilibrium prices to producers in the two supply regions would reflect the equation of aggregate demand and aggregate supply in both regions, and would differ by the additional transport costs. Existing regional price differentials reflect the "efficient" differential only imperfectly.

Using data obtained in the survey of plant reports, average net prices to producers were computed on a county basis to expose interregional differences. The plant reports show total payments to producers, less all deductions for transport and handling charges. Dividing this figure by producer receipts gave the average net price per hundredweight paid to producers by the plant. These prices were weighted by plant receipts from each county to give an average net price received by producers in the county (table 15). In turn, these weighted average prices were adjusted by average milk-fat percentages to remove variations

Table 15. Average Prices Paid Producers for Market Milk in Selected Months, by County

Month	Southern milkshed				Northern milkshed				
	Los Angeles County	Orange County	San Bernardino County	Riverside County	Kern County	Kings County	Tulare County	Fresno County	Madera County
	dollars per hundredweight, average								
Oct., 56............	5.14	5.12	5.16	5.14	4.77	4.40	4.34	4.61	4.40
June, 57............	4.71	4.69	4.72	4.68	4.17	3.66	3.68	3.88	3.72
Oct., 57............	5.11	5.10	5.16	5.12	4.72	4.10	4.14	4.33	4.19
June, 58............	4.71	4.67	4.70	4.66	4.00	3.53	3.56	3.75	3.75
Oct., 58............	5.09	5.06	5.90	5.03	4.75	4.09	4.20	4.35	4.38
June, 59............	4.89	4.82	4.82	4.82	4.13	3.66	3.65	3.91	3.92
	dollars per hundredweight, 3.8 per cent milk fat basis								
Oct., 56............	5.36	5.32	5.28	5.32	4.83	4.37	4.41	4.64	4.48
June, 57............	5.24	5.32	4.94	5.09	4.41	3.95	4.10	4.14	4.14
Oct., 57............	5.28	5.35	5.28	5.32	4.67	4.18	4.23	4.29	4.25
June, 58............	5.28	5.24	5.13	5.13	4.33	3.95	4.03	3.95	4.07
Oct., 58............	5.43	5.43	5.36	5.36	4.79	4.22	4.25	4.41	4.48
June, 59............	5.43	5.43	5.28	5.32	4.45	4.03	4.10	4.27	4.26

Source: Survey of plant reports.

due to that factor. This procedure results in the average prices by county shown in the lower part of table 15. The latter give the most valid measure of geographical price patterns in the supply area. Geographical differences that appear, in both levels and seasonal variations, are due primarily to two factors: areal differences in the proportion of Class 1 and surplus uses of milk produced; and differences in marketing costs, primarily transport and handling charges.

San Joaquin Valley producers receive proportionally less Class 1 utilization than producers in Southern California, or in the state as a whole (figure 11). From the standpoint of relative price patterns, more important has been the growing surplus use of Valley milk, which now exceeds 40 per cent. This percentage has not only increased absolutely since 1956 but has also increased relative to increases in surplus use in Southern California and in the state.

The second factor — marketing

charges — relates to the deductions that distributors are authorized to make from minimum class prices. When purchasing milk f.o.b. plant, distributors are authorized to deduct farm-to-plant transport costs, if the distributor provides, or contracts for, transport services. When market milk is received at one plant and shipped to another for Class 1 use, the cost of this additional transport may also be deducted from producer payments, subject to maximum transport allowances established by marketing area of use. Specifically, distributors may deduct additional transport charges for milk received at plants in the northern milkshed and reshipped to a Los Angeles plant for Class 1 use.

In addition, the Bureau of Milk Stabilization authorizes deduction of a handling charge when market milk is received at a country plant and reshipped to a city plant for Class 1 purposes. This charge is currently a maximum of $.15 per hundredweight for milk. When milk is separated at a country plant and bulk

cream shipped for Class 1 use, the maximum charge is $.035 per pound milk fat.

This measurement of regional price differentials is on an average basis, but observed differences can be related to individual firm revenue structures and differentials allocated graphically between horizontal and vertical revenue shifts (figure 12). Let P_1 be the Class 1 price in Los Angeles and let P_{2-3} be the surplus price for market milk, assumed to be equal in both supply areas. Let $d_s P_1$ be the farm-to-plant transport rate in the southern milkshed. Then, if a producer in the southern milkshed receives the Class 1 price for an amount Q_1, his corresponding average revenue curve is $d_s d_s$. If the producer ships a total quantity per period of Q_t, he would receive a net price of P_s.

Now consider a producer in the northern milkshed supplying milk for Class 1 use in Los Angeles. Let $d_v d_s$ represent the additional cost of transporting milk
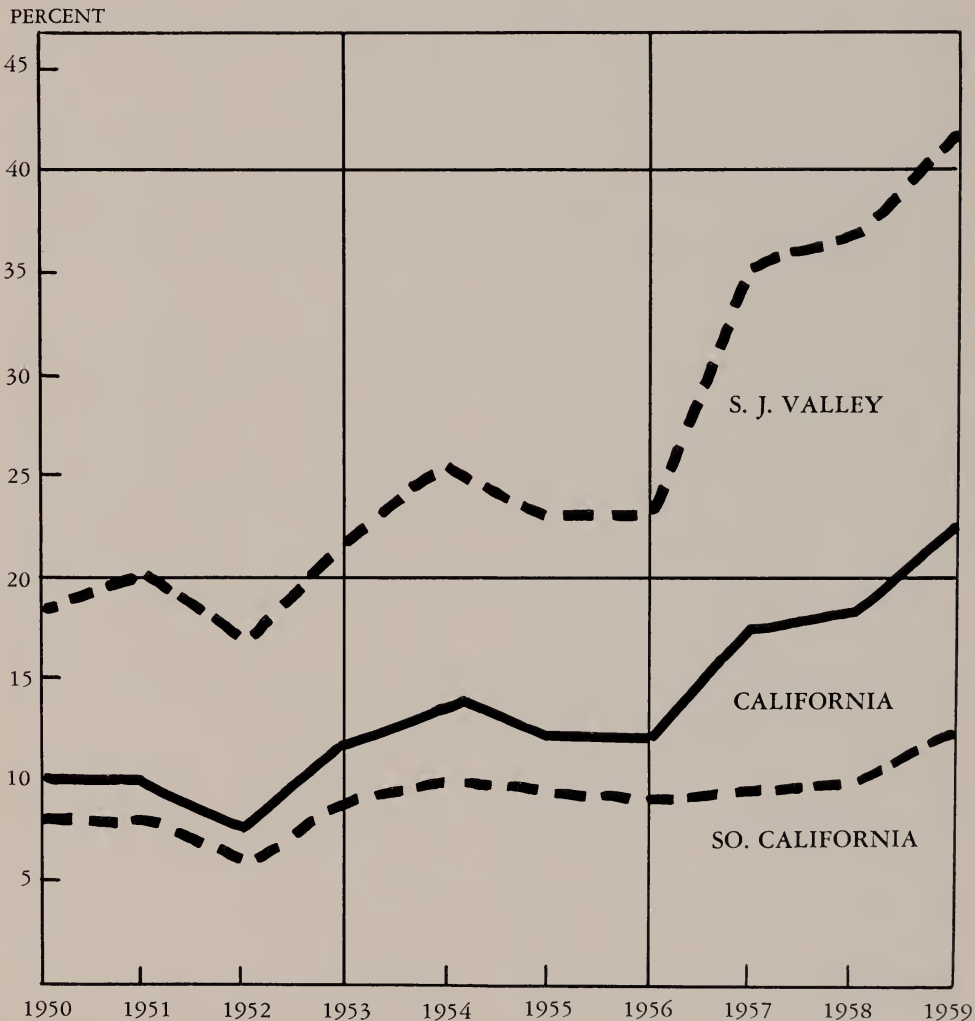
PERCENT

Figure 11. "Other than Class 1" use of market milk fat as a percentage of commercial production in California and in estimated percentages of production in Southern California and San Joaquin Valley, 1950–1959. Source: California Crop and Livestock Reporting Service, Sacramento.
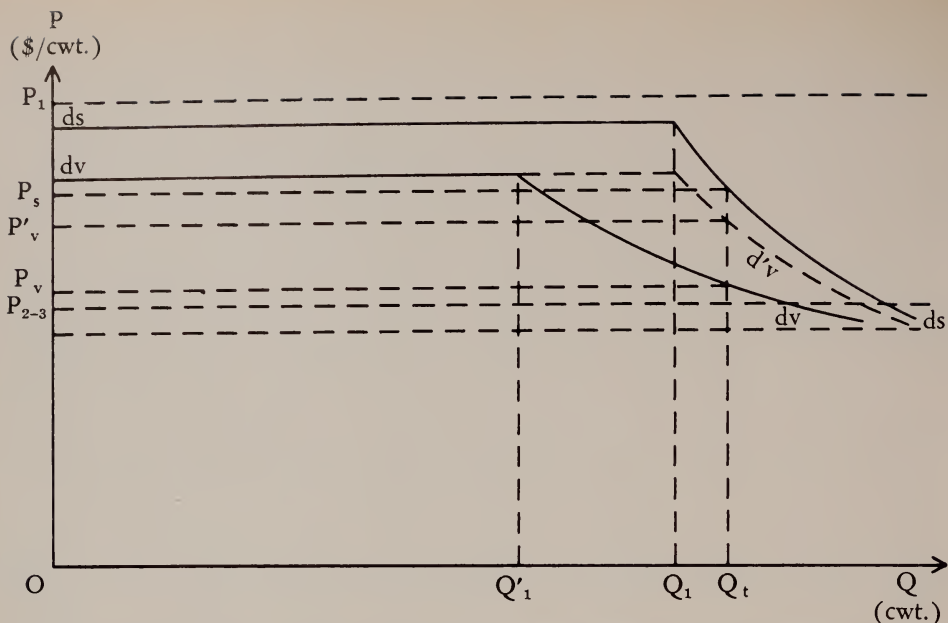
Figure 12. Horizontal and vertical shifts in producer-level average revenue functions, southern and northern milksheds.

to Los Angeles and the country-plant handling charge. Then, if the producer receives the Class 1 price for an amount Q_1', the relevant average revenue curve is $d_v d_v$. If the producer also ships a total quantity Q_t, he will receive a net price of P_v.

If the producers in the two regions receive the Class 1 price for equal amounts, then $d_v d_v'$ becomes the revenue function for the producer in the northern region. For equal total production, $P_v' P_s$ is the corresponding difference in net prices that would be received by the two producers; it represents that part of the original difference resulting from a vertical shift of the revenue curves between areas due to additional transport and handling charges. Similarly, $P_v P_v'$ is that part of the original price differential that results from a horizontal shift in revenue structures between regions due to the varying proportions of production used for Class 1 purposes.

The nature of the added transport and handling charges, and the extent to which

the proportion of surplus use in the northern milkshed exceeds that in the southern, have already been indicated, and provide a basis for a later discussion of alternative methods of bringing inter-regional price differences more in line with the "efficient" differential. The basis for varying proportions of surplus use in the supply areas resides in market supply and utilization patterns, as determined by type and location of buying plants and procurement practices and policies of distributors.

PROCUREMENT PRACTICES, USE PATTERNS, POLICIES OF LOS ANGELES DISTRIBUTORS

Prices for market milk in the supply areas for Los Angeles plants are not determined in free markets by impersonal competitive forces; rather, they involve negotiated transactions between buyers and sellers in a complex institutional framework. As such, they may be controlled within bargaining limits set by the best alternative available to either

party. The present market organization and pricing structure provides an opportunity for buying firms to affect prices in the alternative supply areas in a manner not possible in competitive markets. The use of this market power by buying firms is investigated in this section, and its relationship to revenue conditions in the competing supply areas determined.

Raw-Product Procurement: Purchasing and Concentration Patterns

Products for resale can be obtained by a given plant either by purchase of raw product for processing or by interplant transfers of processed and packaged products. The relative importance of these two procurement methods differs by firm and type of product. Generally, fluid products are processed in the plant from which they are distributed, whereas other products are frequently purchased from other plants for resale, particularly by smaller distributors. Some exceptions exist, especially among plants in different areas belonging to the same firm. Another exception is a cooperative marketing association in Los Angeles that realizes about 10 per cent of its sales in the form of inter-distributor transfers of processed and packaged milk.

Data were not obtained on the amount of movement of processed milk products between plants in this market. Even so, broad, market-wide patterns can be established by types of products. Few plants in Los Angeles have facilities for the manufacture of dairy products other than ice cream and buttermilk. The primary source of processed products, such as cottage cheese and butter, is plants in other areas.

To obtain raw milk received at Los Angeles plants, two general methods are available: direct receipts from producers and bulk transfers of milk or cream from other plants.

Direct producer receipts. During June 1959, the 142 Los Angeles plants received a total of 176,937,000 pounds of milk directly from producers located in nine different counties (table 16). More than 60 per cent of direct receipts came from producers located in Los Angeles County. There were also significant percentages of direct receipts from the other three counties making up the southern milkshed. Small amounts were received from producers in five additional counties, but these represented less than 3 per cent of total direct receipts. Direct receipts by Los Angeles plants are shown in Column 3 as a percentage of market milk production in the county of origin. Only in the case of Ventura County does this percentage for

Table 16. County Origin of Direct Producer Receipts of Los Angeles County Plants, June, 1959

County	Direct shipments to Los Angeles County plants (1,000 pounds)	Percentage of total direct receipts of Los Angeles County plants	Direct receipts by Los Angeles County plants as percentage of total production in county of origin
Los Angeles	107,671	60.6	100
Orange	25,615	14.3	75
San Bernardino	27,660	15.8	71
Riverside	11,278	6.4	67
Ventura	2,735	1.7	56
Santa Barbara	919	.5	13
San Luis Obispo	380	.2	7
Fresno	342	.2	1
Stanislaus	337	.2	1

Source: Survey of plant reports.

a county not included in the southern milkshed approach that of a county so included. This primarily reflects, not importance as a source of supply, but the small total production in Ventura County—almost 50 per cent of which is produced by a Los Angeles distributor and used in its Los Angeles plant.

In June 1959, milk was received directly from producers at 143 plants operated by 120 firms, leaving five plants that received no raw product as direct shipments from producers. When firms receiving direct shipments from producers were classified by the number of producers shipping, distribution was as shown in text table at bottom of page.

The 101 firms buying from four or fewer producers accounted for 27 per cent of total direct receipts of Los Angeles plants. With only three exceptions, all of these 101 firms received milk only from producers located in Los Angeles County. For the survey month, these firms received 40 per cent of the County's market milk production. Since these plants tend to be specialized fluid milk processors, they typically realize 100 per cent Class 1 use for all milk received, except for small operating surpluses.

Of the 120 plants operated by the 101 firms buying from no more than four producers, 114 had dairies located at the same site. In June 1959, these dairies accounted for 26 per cent of market milk production in Los Angeles County. Although the dairy herd and processing plant may be under the same ownership, it is not unusual to find separate ownerships. In the survey month, 80 firms, operating 90 plants, obtained their entire milk supply from dairies located on the premises; this involved 15 per cent of Los Angeles County production. These operations are largely cash-and-carry and milk production is closely geared to the Class 1 needs of the plant. Moreover, producers receive f.o.b.-plant prices since no local transport is involved. Thus, for production in this category, net prices to producers can be expected to approach the minimum Class 1 price established by the state.

For the 19 firms with plants purchasing from five or more producers, the number of shippers per plant ranges up to a maximum of 120. These 19 firms include the seven regional distributors, the two cooperative marketing associations, and 10 local distributors. In total, these 19 firms accounted for 73 per cent of direct producer shipments in the survey month.

Concentration in the purchase of raw milk is somewhat greater in the Chino district, and fewer firms in total receive milk produced in that area as compared with the southeastern Los Angeles-Orange district (figure 13). In each of the producing regions, however, five firms buy more than 50 per cent of milk produced, and the largest 10 purchasers buy at least 75 per cent. In each area, no plant located outside Los Angeles County ranked among the 10 largest purchasers. In these calculations, the total number of plants purchasing milk in the two areas were considered, whether or not they were located in Los Angeles County.

Inter-plant transfers of bulk milk and cream. The other source of market milk to be processed and packaged for resale is bulk supplies from other plants. A total of 32 firms operating 34 plants re-

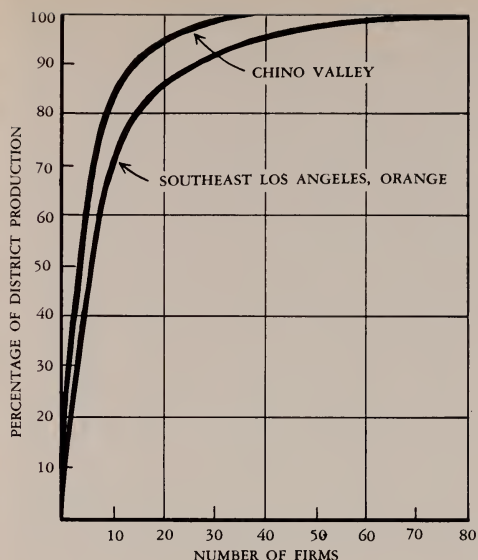| Number of producers	Number of plants		Number of firms	
	Number	Cumulative total	Number	Cumulative total
1	71	71	71	71
2	22	93	16	87
3	15	108	10	97
4	12	120	4	101
5 or more	23	143	19	120

Figure 13. Cumulative frequency distribution of distributing firms by percentage of district production purchased, June, 1959.

volved 591,000 pounds of milk fat in June 1959. After deduction of this amount, 1,524,000 pounds of milk fat was received as bulk transfers by Los Angeles plants from outside the county. Adding this to direct receipts gives 7,574,000 pounds of milk fat as the total raw product received by Los Angeles County plants in June 1959.

The geographic origins of bulk interplant transfers of milk and cream, in addition to intra-county shipments, are southern California, coastal, and San Joaquin Valley counties. The first includes Orange, San Bernardino, Riverside, and San Diego counties; the second, Santa Barbara and San Luis Obispo counties; and the third, all San Joaquin Valley counties. For June 1959, bulk receipts of market milk fat by Los Angeles plants from these three areas were shown in text table below.

Intra-county plant transfers are basically of two types. The first is the irregular movement of milk between plants and between firms to compensate for unpredictable shortages and surpluses. Milk moving between plants on this basis is not an important element in the procurement patterns of plants concerned. Although in any given month the number of transactions may be large, the volume of milk is relatively small.

The second type of intra-county movement of bulk milk and cream between plants arises when one firm procures raw product from another firm on a regular basis. Five firms obtain their entire supply of unprocessed milk and cream in this fashion. In these five cases, purchases are made from only a single supplier—in each instance one of the two cooperative

ported milk or cream receipts from other plants in the survey month. As noted earlier, five of these firms received no milk directly from producers; the remaining 27 firms received both producer shipments and inter-plant transfers. In total, 2,115,000 pounds of milk fat were reported as bulk receipts in milk or cream from other plants, which is 34 per cent as large as direct producer receipts.

If bulk shipments and direct receipts were added together to get a total figure for Los Angeles plants' receipts, some would be counted twice because movements of milk or cream among Los Angeles plants are also reported by the transferring plants as direct receipts or bulk shipments from other areas. Intra-county plant transfers of milk and cream in-

Region	Los Angeles plant Receipts (pounds milk fat)	Percentage of total
Intra-county	591,000	28
Southern California	86,000	4
Coastal	99,000	5
San Joaquin Valley	1,339,000	63

[59]

marketing associations operating plants in the county. In June 1959, purchases of market milk fat by the five firms amounted to 188,000 pounds, or 32 per cent of total intra-county plant transfers. In the survey month, more than 80 per cent of the amount of milk fat purchased by the five firms went to a single plant— one of the captive creameries. Sales of this firm rank it among the 10 largest in the county. The other four are small-volume firms.

Further study of procurement patterns reveals that an additional 12 firms purchase bulk milk or cream on a regular basis from the two cooperative associations. Contracts are usually for 100 per cent Class 1 use, although some provide for limited amounts of Class 2 use. In each of these cases, the purchases usually represent only a relatively small part of the buying firm's total supply; the buyers are all among the 25 largest firms in the county. In the survey month, sales of this type totaled 343,000 pounds of milk fat, or 58 per cent of intra-county transfers. When combined with the plant transfers discussed earlier, intra-county transfers of the two cooperatives accounted for about 90 per cent of the total. This type of sales made up about 50 per cent of total milk fat sales of one cooperative, and about 60 per cent of total milk fat sales of the other.

Shipments from plants in other southern California counties tend to be numerous but small and of irregular magnitude. They are essentially part of the balancing operation, which also accounts for a part of the inter-plant transfers among Los Angeles plants. Shipments from the coastal counties are usually accounted for by a single plant, which was the case for the month studied. At most, three Los Angeles firms receive milk or cream from this area, and it is only for the single firm that the shipments are substantial and regular. In total, 13 firms reported bulk receipts from plants in the San Joaquin Valley

in the survey month. Records indicate that two other firms frequently procure milk from Valley plants, though they received none during June 1959.

Inter-plant shipments from the San Joaquin Valley originate from proprietary and cooperative plants, and may be further classified as intra- or inter-firm. The relative importance of the various types of plant-to-plant shipments for a 6-month period is shown in table 17. Lack of more adequate time series precludes generalizations about changes in the level and proportions of the various types of plant transfers.

The intra-firm transfers of proprietary firms involve the seven regional distributors operating plants in Los Angeles County, and have constituted more than 60 per cent of total shipments from the San Joaquin Valley in each month for which data were obtained. It appears that six plants in the northern milkshed fulfill country-plant functions for six regional firms. These are at Bakersfield, Tipton, Tulare, Visalia, Hanford, and Lemoore. The seventh regional distributor operates a plant at Bakersfield, but it is primarily a fluid-milk processing plant and does not ship a significant portion of the raw-product supply for the firm's Los Angeles plant.

The importance of the six country plants in the shipment of milk from the northern milkshed to Los Angeles is shown in the last column of table 19. In the six months covered, the shipments of the country plants accounted for 50 to 75 per cent of the total.

Intra-firm transfers by cooperatives originate from plants of member associations of the federated sales cooperatives in the San Joaquin Valley. Although they are tabulated as receipts by the Los Angeles plant of the cooperative, they frequently go directly to the Los Angeles plant of a distributor who purchases unprocessed milk or cream from the association. Inter-firm transfers by cooperatives involve sales to Los An-

Table 17. Classification of Inter-plant Transfers of Bulk Milk and Cream from the San Joaquin Valley to Los Angeles in Selected Months

Month	Proprietary plants		Cooperative plants		Total valley shipments	Shipments of 6 country plants	Percentage of total
	Intrafirm	Interfirm	Intrafirm	Interfirm			
	pounds milk fat						
June, 1959...................	992,000	65,000	170,000	112,000	1,339,000	912,000	68
Percentage of total.........	74	5	13	8			
Oct., 1958....................	1,030,000	32,000	251,000	336,000	1,649,000	925,000	56
Percentage of total.........	62	2	15	20			
June, 1958...................	1,099,000	23,000	147,723	147,254	1,417,000	1,062,000	75
Percentage of total.........	78	2	10	10			
Oct., 1957....................	1,057,000	57,000	165,743	254,850	1,535,000	937,000	61
Percentage of total.........	69	4	11	17			
June, 1957...................	827,000	29,000	208,254	211,770	1,276,000	999,000	63
Percentage of total.........	65	2	16	17			
Oct., 1956....................	1,168,000	41,000	257,018	249,778	1,716,000	923,000	54
Percentage of total.........	68	2	15	15			

SOURCE: Survey of plant reports.

geles plants by three other cooperative associations in the San Joaquin Valley. They are received at proprietary plants, since the latter producer groups are not affiliated with the federated sales cooperative.

Procurement and Use Policies of Regional Los Angeles Distributors[10]

The basis for current procurement policies of these Los Angeles firms is considered here within a context of the development of the market supply structure. The San Joaquin Valley, originally a supplier of cream to the Los Angeles market, became a source of milk and cream when the state adopted a Grade A ordinance and a statewide coordinated program for sanitary control. The general surplus situation during the 1930's and early 1940's placed the Valley again in the role of supplying only cream to the city market. This situation changed drastically during World War II. Because supply was short, all market milk in the

state was able to find a Class 1 market. At the same time, regional distributors moved out facilities for handling surplus milk, converting their Los Angeles plants to specialized operations for processing fluid products and, in some cases, ice cream and buttermilk. This use pattern was encouraged by area differentials in prices of milk for surplus use that were sufficient to provide lower at-market costs for products such as cottage cheese and ice cream mixes when they were processed in the northern milkshed and transported to Los Angeles. The regional price differential between Class 2 and Class 3 use has been continued. In June 1959, it was $.43 per hundredweight of milk.

After the war the raw-product supply remained tight. Regional distributors developed a supply for their country plants based on a 50 per cent Class 1 guarantee. Actual Class 1 use of milk fat received at country plants usually exceeded this figure, reaching as high as 90 per cent in the "short" months. A seller's market existed through the Korean War period. Any producer who could qualify for Grade A production was able to obtain a contract. During the Korean period, at

[10] This section is based on interviews with officials of the regional firms and with Martin Blank, Consulting Agricultural Economist, Los Angeles.

least one regional distributor and one cooperative obtained cottage cheese from outside the state.

In 1953, the supply situation eased considerably in California, mainly because market milk production expanded in the San Joaquin Valley. Country plants would no longer take any producer who wished to produce market milk. Also, separate pricing of milk fat and skim milk had been adopted. Contracts for country-plant shippers were established with the contract amount based on the producer's shipping record and the total quantity the plant could handle profitably. Guarantees for Class 1 milk fat use were set at 50 per cent. Since Class 1 use in country plants is typically less for skim milk than for milk fat, guarantees for skim milk were lower, usually not more than one-half the milk fat guarantee.

Other differences existed between policies of regional distributors in the southern and northern milksheds. In the **southern milkshed,** producers were held to base and given what approximated a 100 per cent Class 1 market for milk produced. Although some variations existed between distributors, overbase milk would usually be accepted only if the distributor could handle it as Class 1. While contracts were usually written for not more than 90 per cent Class 1 guarantee, payments were actually as high as 100 per cent of base, and sometimes higher. The number of shippers per plant tended to decline because of liquidation of some dairies and consolidation of herds into larger units. Increases in plant sales were reflected in larger contractual quantities for existing shippers more than in a larger number of shippers.

In the northern milkshed the country plants were basically used to provide milk to meet weekly and seasonal sales variations, cream for Class 1 utilization, curd and cream for cottage cheese, and fat and nonfat solids for ice cream. Class 1 milk fat and skim milk guarantees established at below-minimum-use levels provided needed flexibility to meet weekly, seasonal, and random variations in sales in the city market. Equipment was provided so that excess milk could be used for Class 3 purposes (butter, powder). The more storable Class 2 products permitted using a fluctuating supply in filling varying Class 1 demands without causing a deficit in supply of Class 2 products.

Another important difference was the willingness of firms to take on new shippers to county plants rather than increase receipts through larger bases for existing shippers. Several factors influenced this policy. Perhaps most important were those assuring a stable supply to meet expanding future needs. Other factors include obligations of firms to established Grade B shippers wishing to convert to market milk production, and the fear of concentrating control of the plant's supply among a few large producers. Also, conversion of Grade B producers could eliminate the need for maintaining dual receiving facilities and provide a large supply of high-quality milk for Class 2 products, at no penalty to distributors as long as surplus class prices were kept in line with prices for manufacturing milk. It is not possible, however, to prove that large numbers of producers have been added to country-plant shippers. Data since 1956 indicate that only two country plants had more shippers in 1959; the other four had fewer. In the aggregate, decreases outweighed increases by 3 to 1. The important conclusion is that the firms during this period were *willing* to accept new producers, although withdrawals and consolidations have resulted in little change in *number* of shippers.

Policies with respect to overbase shipments have also varied between the southern and northern milksheds. Country plants tend to receive more overbase milk than city plants (table 18). Lack of facilities to process large volumes of Class

Table 18. Comparative Levels of Overbase Receipts, Los Angeles and Country Plants, June, 1959

Plant	Monthly contract base	Class 1 guarantee milk fat	Total producer receipts June 1959	Producer receipts as a percentage of contract base	Producers
	pounds milk fat	*per cent*	*pounds milk fat*	*per cent*	*number*
Los Angeles					
A........................	903,780	100	929,399	103	123*
B........................	439,110	90	563,677	128	50
C........................	488,790	86	520,365	106	53
D........................	384,750	90	419,378	109	65
E........................	273,300	75	275,661	101	36
F........................	195,600	85	211,249	108	32
Country					
A........................	10,014,030†	50	13,121,207†	131	101
B........................	423,870	50	469,946	111	126
C........................	144,720	50	195,447	135	42
D........................	249,570	75	293,323	118	47
E........................	299,550	50	314,854	105	76
F........................	141,900	50	173,431	122	29

* Single contract for supply from a cooperative bargaining association.
† Pounds milk.
SOURCE: Survey of plant reports.

2 and 3 products force distributors to restrict producers in the southern milkshed to contract amounts and discourage overbase shipments unless the milk can be used for Class 1 purposes. It is frequently asserted that an entirely opposite policy has been followed by some country plants—that implicit requirements for overbase shipments are enforced by distributors under threat of base reductions or contract cancellation.

Data in table 18 show contract bases, Class 1 guarantees, and total receipts for the city and country plants of 6 major distributors in June 1959. Only for firm B were overbase shipments to a city plant relatively larger than for the corresponding country plant. The explanation for this case is that the firm has surplus-handling facilities (butter churns) at its Los Angeles plant, whereas its Valley plant is specialized for cottage cheese production and has no standby facilities. Thus, the distributor is reluctant to receive more milk at his country plant than can be reshipped for Class 1 use or used in Class 2 products. The lack of standby

equipment is even more strongly operative in the country plant showing the lowest percentage of overbase shipments.

For each plant, contracts tend to be standardized with respect to Class 1 guarantees and other general provisions. The major item showing variation among a given plant's shippers is the contract base. This strongly affects the comparative net returns of a plant's producers. Recall that, for two producers shipping identical amounts of milk to the same plant and receiving equal *percentage of base* in Class 1, the blend price will be higher to the producer with the larger base than to the producer with the smaller base, because of the differences in proportions of total shipments that are paid for in Class 1 use. Thus, the determination of base becomes the major item for negotiation between the buyer and seller. Some distributors have followed a policy of uniformly adusting bases on a percentage basis; others have followed a policy of granting periodic increases in base to producers who consistently produce a stable supply of high quality milk, or

shippers who have demonstrated a willingness to produce large quantities of overbase milk.

Variation in contractual provisions for plants within and between areas is significantly large, reflecting primarily the processing and supply function of the individual plant and producing district. Plant use depends on the type of products processed and/or shipped. Individual plants may experience wide seasonal variation in the proportion of class uses of milk fat and skim milk. It seems reasonable to expect a consistently higher Class 1 use of a single component of milk to be reflected in the level of guarantee. For example, Class 1 guarantees in country plants that typically realize a lower Class 1 use are lower for skim milk than for milk fat. In Los Angeles plants skim milk guarantees more nearly approximate the level for milk fat.

The more useful comparisons are of prices paid producers by Los Angeles and country plants (table 19). Differences in prices between country and city plants of the same firm tend to be much larger than differences among the city plants and among the country plants. The same increase in the regional differential in prices received by producers in the

northern and southern milksheds is evident here, as well as in the data based on average prices presented in table 15.

For a period following the Korean War, country-plant producers continued to enjoy Class 1 use of contracted milk fat of 70 to 90 per cent, although Class 1 skim milk use frequently dropped to summer lows of 25 to 30 per cent. The year 1956 was favorable for country-plant shippers. Some plants paid Class 1 prices for as high as 80 per cent of total shipments, including overbase. The total volume of milk procured from the Valley for Class 1 use in Los Angeles seemed to be on the increase. Some observers speculated that production in the southern milkshed, especially in Los Angeles County, where producers were faced with rising labor costs and land values, had reached its peak and would decline.

In this economic environment San Joaquin Valley country-plant producers formed a new producer bargaining cooperative. Expanding in membership through 1956, the organization militantly attempted to gain control of the Valley supply and dictate purchase terms to buyers. Reaction by distributors was swift. Some began to increase contract bases of producers in the southern milk-

Table 19. Average Net Prices Paid Market Milk Producers in Selected Months, Los Angeles and Country Plants

Plant	October 1956	June 1957	October 1957	June 1958	October 1958	June 1959
	dollars per hundredweight					
Los Angeles						
P_1	5.07	4.62	5.09	4.59	5.04	4.78
P_2	4.94	4.56	4.92	4.49	4.89	4.64
P_3	5.15	4.70	5.10	4.67	5.03	4.76
P_4	4.96	4.53	4.95	4.45	4.83	4.58
P_5	5.30	4.91	5.35	4.76	5.14	4.82
P_6	5.17	4.91	5.35	4.81	5.21	4.95
Country						
P_1	4.41	3.49	4.17	3.35	4.26	3.48
P_2	4.40	3.86	4.29	3.69	4.21	3.87
P_3	4.38	3.64	4.12	3.33	3.88	3.76
P_4	4.45	4.03	4.52	3.85	4.61	4.04
P_5	4.39	3.67	4.06	3.61	3.99	3.80
P_6	4.29	3.82	4.24	3.87	4.26	3.84

Source: Survey of plant reports.

shed because they themselves were concerned about stability of the Valley supply. Some large distributors actively opposed participation of their country-plant shippers in the bargaining group; in a few cases, contracts were actually canceled when producers would not withdraw their membership.

In retrospect, it is clear that the major factor vitiating the bargaining position of the Valley group was the unsuspected eagerness of producers in the southern milkshed to buy cows and increase their production of milk. The opportunity to decrease average costs through increasing the number of cows milked when existing plants were not being operated at capacity rates partly explains their interest. Subsequently, the bargaining group found itself unable to develop alternative market outlets for its members' milk, lost membership, and is no longer regarded as an effective instrument for increasing the bargaining power of Valley producers.

The recent deterioration in the income position of country-plant shippers to Los Angeles distributors, and northern producers in general, cannot be attributed solely to the conflict over the bargaining cooperative. Undoubtedly, the decision of some distributors to expand local supplies did decrease the total amount of milk demanded from the Valley for Class 1 use. In addition, producers increased rather than decreased the flow of market milk, in spite of deterioration in net prices. The present high surplus levels are the result. The over-all impact of the joint operation of these forces has been: (1) failure of distributors to increase bases and permit expansion of Valley producers; (2) virtual elimination of entry through conversion from manufacturing to market milk production, except within some cooperative groups; and (3) cancellation of some contracts.

Currently, regional distributors have generally returned to the policy of restricting producers in the southern milk-

shed to base and discouraging overbase shipments. Moreover, at least two firms have instituted base reductions—one by 10 per cent and the other by cancelling a normal 6 per cent seasonal increase in base. One cooperative association has found it necessary to ship some milk north into the San Joaquin Valley for disposition in manufacturing uses; consequently, it has taken stronger measures to hold its producers to base.

Even more significant, some country-plant firms recently appear to have departed from their policy of encouraging overbase shipments by Valley producers. The supply of milk received at some country plants is exceeding the amount that is needed for Class 1 purposes and that can be used in Class 2 products. Some of the plants have no Class 3 facilities, and for firms that possess them the profitability of processing these products is questionable. At least three firms have taken steps to restrict Valley shippers to base. In addition, one distributor in the Valley is experimenting with contracts that would not obligate the distributor to accept overbase shipments and would not penalize the Class 1 guarantee of a producer shipping less than his contract amount for a given month. In the past, contracts have provided for proportional reductions in guaranteed amounts if shipments are under quota. Under the new policy, it is theoretically possible for a producer to ship only the amount of his Class 1 guarantee; hence, he would receive Class 1 price for the entire amount. A nearby producer shipping to the same plant may continue to produce large quantities of overbase milk, which would cause his blend price to be significantly lower than that of his neighboring producer.

Role of Cooperatives in Market Supply Patterns

Five local distributors, besides the regional distributors and the federated cooperatives, reported receiving bulk ship-

ments of milk or cream from plants in the San Joaquin Valley in June 1959. All of these shipments were from the plants of three cooperative associations.

The primary motivating force behind these purchases is the same as that behind those of regional distributors buying from the Los Angeles cooperatives: a need to establish supply patterns offering the flexibility necessary to meet fluctuations in demand. Perhaps this is best illustrated in the case of the two local distributors who procure relatively larger proportions of their supplies from Valley cooperatives and who are captive firms specializing in distribution of milk through retail stores. The pronounced weekly cycle in sales of these firms implies that supplies of raw products on Thursdays and Fridays must substantially exceed supplies on other days. Hence, they need correspondingly greater supplies to supplement daily receipts from direct shippers. Similarly, distributing firms with a high proportion of school sales experience above average seasonal variation in demand which may be reflected in purchases from a cooperative plant supplying the firm.

Thus, cooperatives play for local distributors much the same equalizing role that country plants do for regional distributors. To the extent that seasonal and weekly sales variations are reflected in the timing and level of purchases from cooperatives, cooperative producers will experience greater variation and proportionally less Class 1 use than direct shippers to local distributors. Since minimum class prices apply to the sales of producer cooperatives to distributors—and under current supply conditions, the minimum prices prevail—procurement of weekly and seasonal supplemental supplies in this way may result in net costs for the buying firms being lower than if their entire supply was purchased directly from individual producers. The latter implies that the distributors would be faced with the necessity of handling weekly and/or seasonal surpluses, in addition to normal operating reserves.

MAXIMUM-PROFIT LOCATION: IMPLICATION FOR SUPPLY ADJUSTMENTS

Efficiency of Market Supply and Use Patterns

For aggregate transportation costs to be minimized, shipments of fluid milk to Los Angeles from the northern milkshed should originate from producers nearest the market. In June 1959, a total of 1,339,000 pounds of market milk fat was shipped to Los Angeles plants as bulk milk and cream. For the same month, about 1,850,000 pounds of market milk-fat in excess of local Class 1 use was produced in Kern, Tulare, and Kings counties, California Crop and Livestock Reporting Service (D 1959). The movement of individual units of milk could not be traced with available data, but it did show that plants shipping to Los Angeles purchased 46, 93, and 77 per cent, respectively, of the production in those counties. However, these plants also received 66 per cent of production in Fresno County and 70 per cent in Madera County, as well as smaller percentages of production in Merced, Stanislaus, and San Joaquin counties.

It appears on this basis that transport costs are above the minimum level that could be achieved by optimum organization of shipments, although the precise amount by which transport costs exceed the theoretical minimum is not known.

In contrast, the industry closely approximates the theoretical ideal for use patterns. A very high proportion of all milk produced in the southern milkshed is used for fluid purposes. Supplies in the northern milkshed, when not required for fluid purposes, are held at local plants for processing into Class 2 and 3 products. This is an efficient result, because

of transport economies in shipping the processed products.

Thus, it can be concluded that use patterns in this supply area are of the type that location theory indicates would reflect desirable performance in the industry, even though transport costs for milk shipped to Los Angeles are somewhat above their theoretical minimum. Associated with existing use and supply patterns, however, are the regional differentials in net prices received by producers. These are intimately bound up in locational choices of individual firms, and are investigated in this section to determine their relation to maximum-profit location.

Regional Differentials in Net Returns to Producers

The analysis in this section uses previously developed cost and revenue data to indicate net returns for synthesized operations in the two areas of the milkshed. To facilitate comparisons, a 60-stanchion barn is used with varying herd sizes. Most barns in the southern milkshed are larger, and many in the northern milkshed are smaller, but the existence of essentially constant long-run average costs of production makes it possible to generalize conclusions based on comparisons with a single barn size. Prices used are established minimum class prices for the Los Angeles and Kings County marketing areas.

Table 20 indicates net returns to producers per hundredweight of milk for varying herd sizes. It is assumed that the specified percentages of Class 1 and surplus uses apply to total production. Thus, production of the larger herds involves the same proportion of Class 1 use as does production of the smaller herds. This assumption is made because the primary interest is in interregional comparisons, rather than intra-regional differences in net revenues as a result of increasing production in the face of fixed contract bases. In the latter case, blend prices would decline as herd size increases, rather than remain constant as in the example, because of the larger proportion of production going into surplus uses.

Table 21 suggests that only for the

Table 20. Average Costs, Producer Prices, and Net Returns with 60-Stanchion Barn and Alternative Herd Sizes, by Region

Item	Southern milkshed			Northern milkshed		
	120 cows milking	180 cows milking	240 cows milking	120 cows milking	180 cows milking	240 cows milking
	dollars per hundredweight, 3.5 per cent milk					
Average costs........................	4.40	4.05	3.88	3.52	3.31	3.22
Blend prices*..........................	5.04	5.04	5.04	4.30	4.30	4.30
Transportation and handling charges†..	.15	.15	.15	.40	.40	.40
Net returns...........................	.49	.84	1.01	.38	.59	.68

* Southern milkshed: 90 per cent Class 1 use, milk fat and skim milk; Class 1 prices, $1.00 per pound milk fat and $1.75 per hundredweight skim milk; Class 2 and 3 prices, $.66 per pound milk fat and $1.43 per hundredweight skim milk.
  Northern milkshed: 65 per cent Class 1 use, milk fat and 35 per cent skim milk; Class 1 prices, $1.00 per pound milk fat and $1.40 per hundredweight skim milk; Class 2 and 3 prices, $.66 per pound milk fat and $1.00 per hundredweight skim milk.
† Southern milkshed: $.15 per hundredweight farm-to-plant.
  Northern milkshed: $.15 per hundredweight farm-to-plant; Class 1 use, $.15 per hundredweight or $.035 per pound milk fat country-plant handling charges, $.45 per hundredweight transportation to Los Angeles.

smallest herd size considered would net returns in the northern milkshed equal those that could be obtained by a comparable operation in the southern milkshed. When compared to capacity production in the southern milkshed, returns for producers in the northern region are only 60 to 80 per cent as large, depending on herd size. In all cases, producer price differentials are at least sufficient to offset higher production costs in the southern milkshed.

Per-unit transport and handling charges computed for the northern milkshed are not as large as the "efficient" interregional price differential based on the economic model. This results from the fact that country-plant handling and Los Angeles transport charges are deducted only from milk shipped for Class 1 purposes; milk used at country plants for processed products has only farm-to-plant transport charges deducted. Under the assumptions of the model, however, the lower regional price would apply to all milk produced in the surplus region.

Implications for Supply Adjustments

Although, for the case considered, the *vertical* shift in producer revenue curves between regions is not as large as would be expected under perfect competition, a large *horizontal* shift to the right is sufficient to offset production cost differentials, and render the southern milkshed the most advantageous location for producers with large herds. Thus, it would pay a producer to locate in the southern region even though production costs are lower in the northern milkshed by more than enough to offset added transport costs.

The market organization that has evolved is based on use of production in the southern milkshed for fluid purposes, procurement of weekly and seasonal supplemental supplies from the northern milkshed, and retention of surplus production in the northern region for processing into products. Such patterns are quite consistent with minimization of aggregate transport costs, and with maximization of the value of the raw product, given the location of production and minimum class prices.

In terms of desirable adjustments in spatial allocation of resources, this situation is clearly one of a distorted interregional supply which is inconsistent with efficient long-term growth in industry output. It is basically a situation in which the factors originally responsible for locating an industry have worked themselves out and disappeared, while the industry has tended to remain where it was started. Adjustments of southern producers to rising factor costs, including conservation of expensive land, dependence on imported feed, and large, specialized operations, also resulted in the production of a stable high-quality supply of milk that minimized procurement problems for buyers, generating strong vested interests in existing supply patterns. Institutional pricing procedures have provided no incentives for distributors to seek lower-cost sources of supply. Thus, supply and use patterns, and resulting producer revenue relationships are deeply imbedded in the market organizational, institutional, and historical relationships. Their net effect is to encourage production to persist in the original—and at present high-cost—location, or to restrict locational choices of producers to areas in which no horizontal movement of their revenue curve takes place. Expansion of existing producers in, or movement of new producers into, the low-cost region is discouraged.

This clearly raises important policy questions with respect to the role of institutional pricing arrangements in maintaining the distorted supply relationships, and alternative procedures designed to encourage supply adjustments more in line with the optimum. The final section is devoted to these and related questions.

V. SUPPLY ADJUSTMENTS—
PAST, PRESENT, AND FUTURE

FROM A TOTAL POPULATION of 9 million in 1960, the seven-county southern California Metropolis is expected to reach 13 million in 1970 and 16.7 million in 1980. Future population growth is likely to center in four distinct areas of the extended metropolis: Los Angeles-Orange, San Bernardino-Riverside, Ventura-Santa Barbara, and San Diego. The 1980 population is projected to be distributed among the four areas as follows (Southern California Resource Council, 1960, p. 12):

Los Angeles-Orange	11.9 million
San Bernardino-Riverside	2.0 million
Ventura-Santa Barbara	.8 million
San Diego	2.0 million

Total consumption of milk and dairy products in a market area is closely associated with population. This indicates that the consumption levels in the metropolis and its constituent areas can be expected to increase rapidly. Other factors that will encourage higher levels of consumption include rising real per capita incomes and a higher proportion of the population in the 0–24 age group—50 per cent as compared to 38 per cent in 1950 (Southern California Research Council, 1960, p. 15). The latter factor will have an even more important bearing on the market demand for a product such as milk, which is widely regarded as a necessary item in the diet of children, adolescents, and young adults.

Los Angeles plants currently receive about 70 per cent of their supply of unprocessed milk and cream direct from producers. Of total producer receipts, 97 per cent comes from producers in the four-county area composed of Los Angeles, Orange, San Bernardino, and Riverside counties. The other source of unprocessed milk and cream for Los An-

geles plants—bulk transfers of milk and cream from other plants—provides about 30 per cent of their total supply. Plants in the San Joaquin Valley supply about 90 per cent of bulk receipts from outside Los Angeles County.

Los Angeles plants are likely to continue to draw the greatest part of their raw product supply from these two areas, the southern and northern milksheds. Empirical analysis of the balance of competition between the major supply regions indicates that cost differentials in the northern milkshed now more than offset the advantage of production close to consumption. Regional differences in net prices received, however, are such that a producer in the southern region may, with operations similar in plant organization and herd size, realize larger net returns than a lower-cost producer in the northern milkshed.

This regional price advantage, deriving from the institutional pricing structure and market supply and use patterns, is of great importance in predicting future supply sources. Assuming a continuation of the present market organization and pricing structure, the relevant question becomes the extent to which urbanization may limit milk production in the southern milkshed. Such a limitation would imply procurement of larger quantities of milk from the northern milkshed for Class 1 purposes, and a corresponding diminution in regional price differences, all other things being equal. The following section considers the prospects for production in the southern milkshed, under the assumption that favorable price differentials will continue.

SUPPLY PROSPECTS IN THE SOUTHERN MILKSHED

There are several ways in which population growth and industrial develop-

ment tend to "limit" directly milk production in an area.

One way in which urbanization applies pressures on dairymen to relocate is through conflicts between dairymen and their residential neighbors over odors, flies, and animal and dairy noises. Complaints to local officials have sometimes forced dairymen to reduce operations, and in some cases permits have been revoked. Dairymen have often been forced to undertake costly programs to control the sources of complaints, thereby reducing profits. In other cases, dairymen have found themselves in the position of prior nonconforming uses when residential or commercial zoning is applied to their area. The result may be to deny the producer the right to expand or improve his operation for greater efficiency and profitability. Finally, nearby open areas which had been used for waste disposal no longer can be so used because of subdivisions, raising a serious and potentially costly waste disposal problem.

The second way in which urbanization encourages relocation of dairies is through inflation of land values, increasing the fixed costs of established operations through higher taxes and tempting producers to sell their land to capitalize on rising values. Values of dairy land are reported to have reached as high as $20,000 per acre in some parts of Los Angeles County. Since assessments for property taxes are designed to reflect the "fair market value" of the property, tax burdens would increase even with a static tax rate. Rising tax rates have been the rule, accelerating the increase in taxes. At the extreme, taxes might rise to the point where net returns over direct costs of production only barely cover, if at all, the taxes assessed against the producer's land, improvements, and cattle. This, in effect, would force the producer to liquidate his holdings and move to a new location.

In response to this situation, efforts were initiated as early as 1940 to zone areas for the needs of the dairy industry. Early efforts died because dairymen were opposed and the objectives and advantages of comprehensive zoning were misunderstood. The efforts were continued after World War II, with the support of local officials, and finally succeeded in 1955 and 1956 when three separate areas were incorporated within the southeastern Los Angeles-Orange producing district to retain them for the use of market milk producers (figure 14).

The first area to incorporate was *Dairyland* in Orange County. The city, about two square miles, has no residential, industrial, or commercial districts within its boundaries. The entire city is zoned A-2—heavy agricultural—with a one-acre minimum tract size. Farm and complementary buildings, as well as residences for dairy workers, are permitted. City ordinances establish a maximum of 20 cows per acre. Since its incorporation, in October, 1955, the city has been gaining dairies at the rate of two or three per year, and in 1960 contained 32 dairies with about 8,300 cows, and produced some 34,000 gallons of milk daily.

The second area to incorporate, and the largest of the three, is in Los Angeles County. *Dairy Valley,* incorporated in 1956, contains 8.75 square miles. The entire city is zoned A-2-5, except for 35 acres permitting commercial uses, in the southeast corner. The main difference in zoning in Dairyland and Dairy Valley is that the latter specifies a 5-acre minimum tract size. Also, Dairy Valley does not limit the concentration of cows. Since incorporation, except for some dairies forced to vacate their holdings for freeway routes, additional dairies have moved into the city. In 1959, six new operations were initiated, and three new ones were established in early 1960. The city now contains 241 active dairies with about 53,000 cows, and produces about 217,000 gallons of milk daily.

The third of the special-purpose incorporations, *Cypress,* in Orange County,
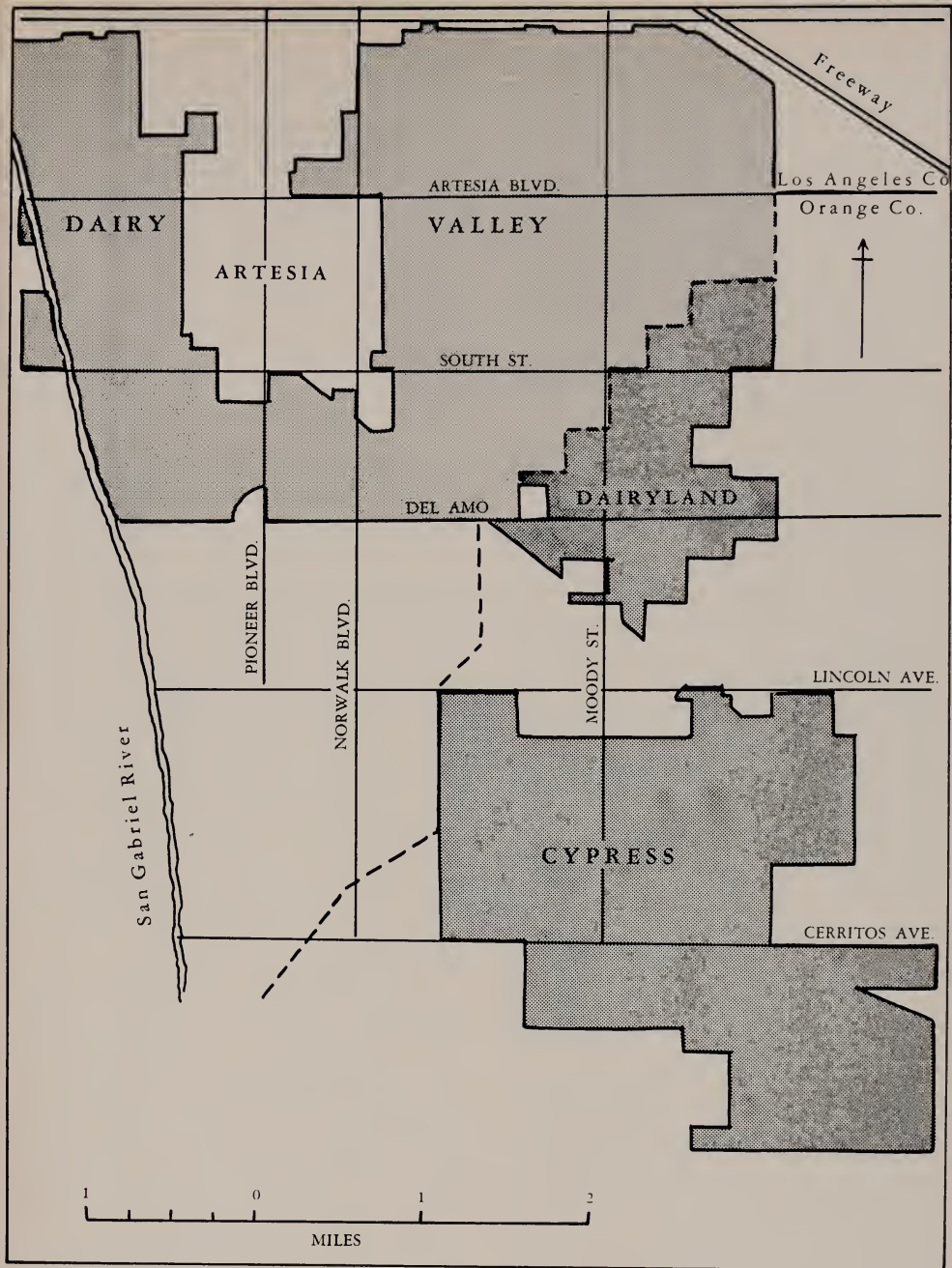
Figure 14. Incorporated dairy areas, Los Angeles and Orange counties.

was incorporated in July 1956, with an area of 7 square miles. Of the total area, 900 acres are zoned industrially, 165 for commercial use, 200 for recreation, and the remainder A-2-1. Similar to Dairyland, the city has an ordinance governing density. For a unit of 15 acres or less, the maximum number of cows per-

mitted per acre is 10, unless the dairy is connected with a sewer, in which case the maximum is increased to 20. For dairies of more than 15 acres, the maximum number of cows per acre is 15, regardless of whether the dairy is on a sewer. Eight new dairies have moved into the area since incorporation. The city now contains 50 dairies with about 14,000 cows, and produces about 57,000 gallons of milk daily.

Advantages that dairymen have gained from protective zoning under localized control have been twofold.

First, the establishment of the "cities" created areas in which dairies are automatically allowed, thus eliminating special permit requirements, and in which a producer could expand or improve his facilities without fear of unnecessary delay or expense. Nuisance complaints from residential areas may continue, especially against producers on the edge of the dairy zones, but the concentration of dairies tends to establish "reasonableness" for the objectionable operations.

The second way in which zoning can be advantageous to dairymen concerns taxes. Theoretically, since residential subdivisions, commercial uses, and industrial developments are excluded, land values in the zoned areas should reflect a discounted stream of future net earnings in agricultural uses. This would tend to stabilize land prices and hold assessed values lower than if assessments were based on highly inflated values reflecting potential subdivision or commercial or industrial use of the land. At the same time, since the need for urban services is minimized, municipal tax rates can be held low or eliminated.

How successful the special-purpose incorporations have been and their role in future supply adjustments in the milkshed are considered below.

Los Angeles and Orange Counties

Of the 80 commercial dairies in Los Angeles County, outside the southeastern district, 66 have plants located at the dairy, and engage in cash-and-carry or producer-distributor operations. Thus, only 14 dairies outside southeast Los Angeles County ship to a distributor's plant at another location. Similarly, of the 45 dairies in Orange County outside the major producing district, 22 have plants located at the dairies. In total, 70 per cent of producers in these areas are engaged in cash-and-carry or producer-distributor sales.

This type of distribution is increasing because the dairymen can earn a higher return when he produces, processes, and sells his milk at the dairy, as a result of 100 per cent Class 1 use and savings on local transport costs. In addition, when the entire operation is under a single ownership, he can make profits from distributive functions as well as from production. Higher returns so obtained are likely to enable the producer to resist longer the pressures of rising land values and increasing taxes. Once a dairyman has invested in a processing plant—which would be worthless to the subdividers or industries that would buy the land—he is likely to resist sale until land values and taxes are significantly higher than those required to induce other dairymen to relocate.

It is anticipated that almost all 37 wholesale dairies, now in Los Angeles and Orange counties outside the major producing district, will relocate, probably before 1980. There is a strong possibility, however, that some of these dairies will be converted to cash-and-carry outlets, and additional cash-and-carry operations will be established.

A possible exception to this general pattern is the Antelope Valley—the large, arid portion of Los Angeles County north of the San Gabriel Mountains where inadequate water, extreme summer heat, and high winds have retarded agricultural and urban development. Its potential, however, if and when adequate water is supplied, has led to an extremely spec-

ulative land market. Periodically, interest arises in increasing milk production by encouraging additional dairies to locate there. Available land and local production of irrigated feed are used to encourage milk production, but efforts have so far been unsuccessful. As indicated, only three dairies, including 625 cows, are now in operation in the area; both the number of dairies and of cows have declined since 1950. While an increase in production is possible, it is not likely in the foreseeable future because areas much better suited to dairying are available.

Southeastern Los Angeles-Orange.

Of the 449 dairies in this district, 50 have plants at the same location, leaving 399 in the wholesale dairy category. The cash-and-carry dairies tend to be concentrated in areas that once were important centers for milk production—such as Downey, Norwalk, Paramount, Bellflower, and Lakewood—but that now are devoted primarily to residential and commercial uses. Only seven cash-and-carry outlets operate within the limits of the three zoned dairy cities. In contrast, 316 (72 per cent) of all wholesale dairies in Los Angeles and Orange counties are contained in the three zoned districts. Thus, the future stability of the dairy cities is of most vital significance to any predictions about supply adjustments in the southern milkshed.

The three cities have to date been quite successful in retaining land for dairies. Because of the nature of the zoning power vested in the individual city councils, this retention should continue until zoning ordinances are modified to permit industrial, commercial, and/or residential uses.

In an interview with officials of the Regional Planning Commission of Los Angeles County, the Director of Advance Planning indicated that an analysis by his staff points to elimination of dairies in Dairy Valley by 1980. However, in a recent publication, the Commission projects population of southeast Los Angeles County to 1980 based on the assumption that no significant increases in population will occur in Dairy Valley (County of Los Angeles, 1959, p. 9). This means that the area either will be retained for dairies and associated uses or that it will change to some restrictive industrial classification. The publication does point out that if the area changes to residential zoning, Dairy Valley could support a population in excess of 37,000.

In any event, restrictive agricultural zoning has imparted at least a short-run stability to the production of milk in Los Angeles and Orange counties. Since incorporation of the dairy cities, producers have moved into the protected areas. Some additional relocation can be anticipated. Land values have continued to rise, ranging at present from $4,500 to $6,500 per acre depending on the desirability of the site for dairy production.

Further intensification of existing operations provides another method of increasing production with given facilities. Expansion of output by increasing herd size, and extending the hours of operation of the milking plant, can be expected to show relatively constant, or decreasing, marginal costs up to plant capacity. The existence of decreasing unit costs for output expansion indicates a relatively high elasticity of supply in the producing district in the short-run. Past changes in output support this conclusion. Therefore, contract bases and distributors' policies with respect to acceptance and utilization of overbase shipments, may substantially limit output below the amount producers would be willing to offer at the blend prices being paid.

In the long-run, in which the producer is free to change location as well as level of output, supply for the district is affected importantly by number of producers as well as output per producer. Within the southeastern Los Angeles-Orange district, a continuous decline can

be expected in the 83 wholesale dairies outside the zoned areas, with complete elimination likely by 1980. A moderate increase in the number of producers in the restricted areas can be expected in the immediate future. Increasing herd sizes, within the framework of capacity limitations, will also tend to offset the continued decline in the number of dairies in other areas of the two counties. The extent and rate of this expansion in herd size will be determined in large part by the policies of distributors with respect to sources of supplies. Recent moves by two distributors to reduce bases, and continuing efforts by other distributors and producer groups to reduce overbase production, do not support expectations for more than moderate production increases in the district in the near future.

The period for which the dairy cities will be retained for large-scale milk production cannot be estimated with any precision. Qualitative analysis suggests that continuing population growth and increasing land values—the latter being reflected, at least partially, in assessed values and taxes—will eventually lead to revocation of the restrictive zoning to permit urban uses. The buildup of these forces is most noticeable at present in Cypress, which already contains some nondairy uses. This supports the belief of many that the transition in this area may begin within the next three years.

The optimum time for relocation is a complex problem in cost-substitution, involving factors such as salvage values on existing plants, investment costs, tax rates, and transport charges. In highly simplified terms, when total unit costs plus transport charges at a new location are less than direct production costs plus transport charges at the old location, relocation will be profitable, other things being equal.

It is not likely, however, that *all* milk production will be forced out by 1980. Assuming that differential pricing is continued for cash-and-carry sales, a significant conversion to cash-and-carry can be expected when transition from milk production to urban uses begins in the zoned areas.

Volume of production in cash-and-carry and producer-distributor operations can be expected to be closely geared to the sales outlets. The current herd sizes for the 116 dairies in Los Angeles County with plants on the premises are:

Size of herd	Number of dairies
9–99	27
100–199	54
200–299	22
300–399	6
400 and more	7

The average herd size is 175 cows. Assuming that the average herd size in cash-and-carry operations will increase to 200, and that the number of cash-and-carry producers in Los Angeles and Orange counties will also increase to as many as 200 by 1980, a total of 40,000 cows, or less than half as many as are currently on commercial dairy farms in Los Angeles County, can be projected for the two-county area.

Operations synthesized in Section III for the southern milkshed assumed a production per cow of 13,699 pounds of milk per year. If this figure is used as average production for 1980, the projected 40,000 cows would produce 548 million pounds of milk. Since projected total requirements in the two counties are 4.6 billion pounds—based on population growth to 11.9 million and per capita consumption of 390 pounds per year—a deficit of more than 4 billion pounds of milk is indicated for fluid milk alone.

Such reasoning underlies the frequent assertions that the San Joaquin Valley can be expected to contribute the major share of fluid milk supplies for Los Angeles plants in the future. The validity of this conclusion depends on not only the accuracy of the projections as to requirements and supply adjustments in the two

counties but also on the extent to which additional productive capacity will be established in other areas of the southern milkshed by relocation of producers from Los Angeles and Orange counties. The following section considers some of the factors affecting relocation, again on the assumption that regional price differentials will persist.

Chino Valley

In the following discussion it is assumed that future liquidation of dairy operations in Los Angeles and Orange counties will involve their relocation in some other area. This reinvestment is encouraged by the capital-gains tax structure, as well as the desire of producers and their families to remain in the milk producing business.

Since 1950, Chino Valley has emerged as an important source of milk supply for Los Angeles plants. The production potential of this area is arrived at by estimating maximum production, and then considering economic factors that will determine the degree to which this maximum can be realized.

The desirable features of the Chino Valley for milk production include good drainage and an adequate water supply. Summer temperatures are higher and winds more prevalent than in the coastal region, but these handicaps are of minor significance.

The primary dairy region is contained in the 70-square-mile southwestern corner of San Bernardino County and the 15-square-mile northwestern corner of Riverside County (figure 15). Of this total area, about 60 square miles are suitable for dairy location. The part in San Bernardino County is under county zoning for general agricultural use. Other uses are severely restricted. The only significant nonagricultural uses are an airport and state-operated penal institutions. A county ordinance currently specifies a minimum tract of 5 acres, but an increase to 10 acres—5 of which to be

kept clear for waste disposal—is being considered.

As an indication of maximum potential, production can be projected to 1980 based on an intensity of production in terms of cows per acre equal to that currently found in Dairy Valley—nine cows per acre. This assumes the development of a strictly dry-lot operation, and the disappearance of crop agriculture. Under these conditions, the 38,400-acre district could hold a total of 345,000 cows which, at an average annual production of 13,699 pounds per cow, would represent a total production of milk of about 4.7 billion pounds per year.

Based on a projected population of 13.9 million and a per capita consumption of 390 pounds of fluid milk per year, total requirements in 1980 for all of Los Angeles, Orange, San Bernardino, and Riverside counties would be about 5.4 billion pounds. Thus, maximum production in the Chino district, plus the residual production projected for Los Angeles and Orange counties, would enable the southern milkshed to supply almost its entire fluid milk requirements in 1980.

The extent to which maximum milk production is realized in the Chino district depends upon: (1) additional movement of dairymen from Los Angeles and Orange counties into the area, and (2) retention of the area as an intensive milk-producing district. Critical to meeting both conditions is continuation of the regional net price differential.

Within a cost-substitution framework for locational choices, relocation of a dairy to Chino from Los Angeles involves
• Higher product transport costs
• Higher feed costs
• Lower wage rates
• Lower investments
• Lower taxes

Because freeways are available, added product transport costs are only $.05 per hundredweight over charges in the southeastern Los Angeles-Orange area. Feed costs tend to be higher because of trans-
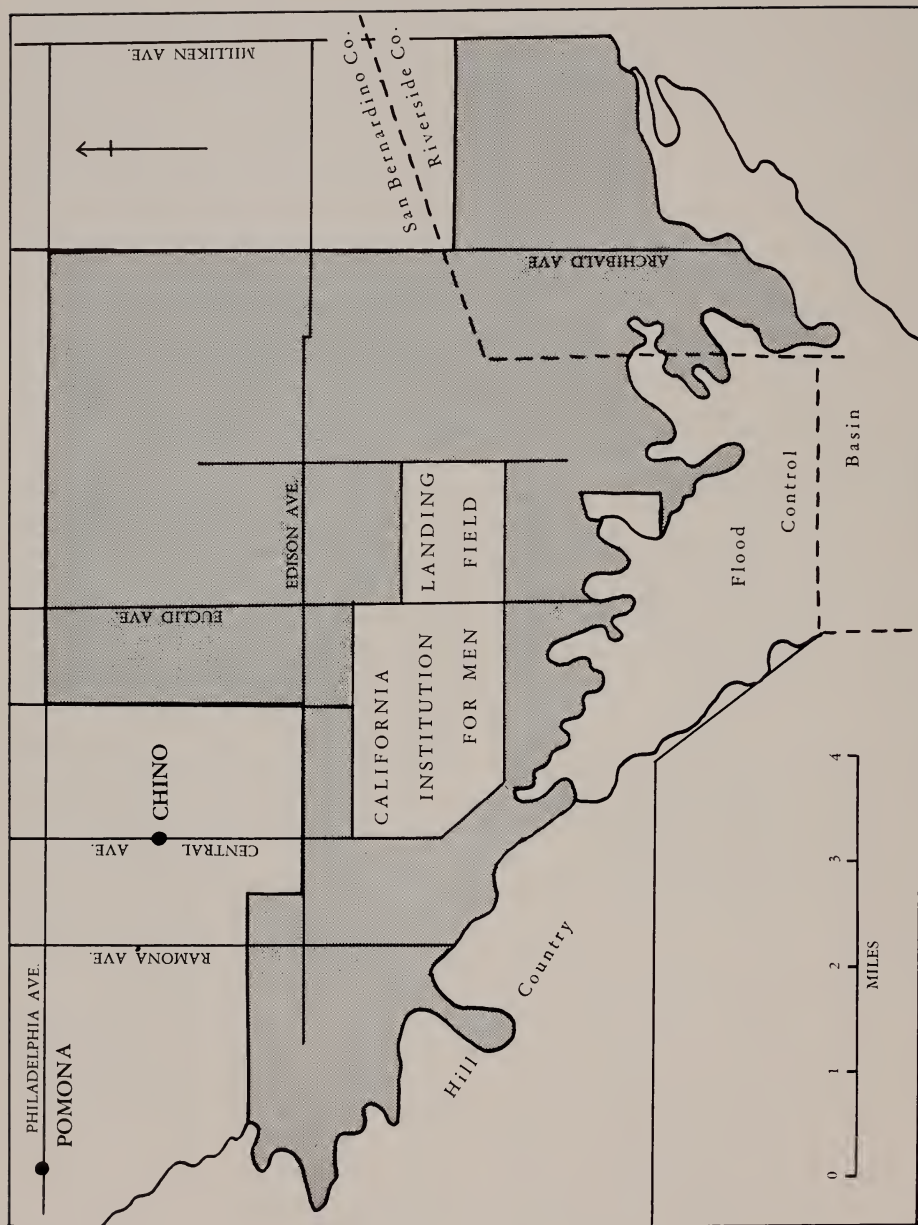
Figure 15. Chino Valley, potential dairy area.

port costs for concentrates from Los Angeles. It is unlikely that the feed supply industry will move to Chino, since it is more economical to remain near ocean transportation and by-products sources, to utilize existing plants, and to transport bulk mixed feeds to Chino. Added charges are about $1.00 per ton. Hay prices are about the same as in Los Angeles.

Existing differentials in wage rates between Los Angeles and Chino are likely to narrow and disappear. Wages in the Chino district will go up as a result of larger and more numerous dairies and increasing industrial competition. Lower investments reflect lower land values, which are currently in the range of $2,500–$4,000 per acre. Lower taxes reflect both lower rates and lower assessments. Increases in the former can undoubtedly be expected. The current policy of the San Bernardino County Assessor, however, is to assess agricultural lands as such rather than at higher values reflecting potential urban uses (*Los Angeles Times*, April 17, 1960, p. 29). Continuance of this policy would be highly favorable to additional location of dairymen in the district.

Retention of the Chino district for milk production is also dependent on industrial and population growth patterns in San Bernardino and Riverside counties. At present, some 90 per cent of the estimated 809,000 residents of the two counties live in the San Bernardino and Riverside valleys of the upper Santa Ana Basin. Significant industrial growth is well under way, primarily in a well-planned tract in San Bernardino County, northeast of Chino between Ontario and Fontana. Additional development into a major industrial complex can be anticipated. The result would be an encroachment of urban and industrial uses in the area, and creation of economic pressures to increase land values and taxes on dairymen, much the same as

occurred in Los Angeles after World War II.

At present, production costs can be lowered by relocating Los Angeles-Orange producers in the Chino district but these costs are likely to increase relative to cost levels in the northern milkshed. Hence, the future supply price for output expansion in the Chino district will be close to that in the southeastern Los Angeles-Orange district, and will exceed that required to call forth additional production from northern producers. Further expansion, as compared to procurement of additional supplies from the northern milkshed, is not desirable from the viewpoint of increasing efficiency in the industry and allocation of resources in line with relative production costs.

However, public officials, especially in San Bernardino County, are actively encouraging expansion of dairying and retention of the Chino Valley as an intensive milk-producing district, and for two reasons. First, retention of the Chino district would provide open area close to points where population growth is anticipated to be greatest. This seems desirable to alleviate congestion and to promote a more pleasant urban environment. Second, large-scale commercial dairying makes a substantial contribution to the area's economy relative to the services it requires. The value of products sold is only a partial measure of the importance of the industry. The large dairy investment represents an important element in the tax base. Many local businesses, such as equipment dealers, hay brokers, and by-product industries, cater to the needs of dairymen. Wages for hired labor, which are very high in comparison with other agricultural wages, contribute to the purchasing power of the area and stimulate other commercial activities. Perhaps even more important, demands for public services, such as water supply and disposal, streets and highways, schools, and recreational facili-

ties, are minimum in comparison with demands in residential development.

Thus, dairying in the Chino area appears at present to be a desirable land use, particularly since any immediate residential expansion would result primarily from population spilling out of Los Angeles County. Dairy production creates a "buffer zone" against population movement out of Los Angeles County.

Outlying Areas

Other possibilities for dairy location in the southern milkshed include outlying valley and desert areas in San Bernardino and Riverside counties, such as the Mojave River Basin and San Jacinto-Hemet, discussed earlier.

The Mojave River Basin lies north of the San Bernardino Mountains. The most favorable dairy area, between Victorville and Barstow, includes the Hinkley Valley, a high desert area, with lower temperatures than the low desert areas. On the other hand, it experiences temperatures below freezing and occasional snowfalls in winter. Water of mountain origin now supports irrigated alfalfa and grain production. With one exception, dairies in the area supply San Bernardino plants. Distance from Los Angeles, to which milk from one Barstow dairy is now being shipped, is 100 to 135 miles. The transport rate is $.35 per hundredweight, but this is a special rate involving a back-haul of processed products. The possibility of fast, efficient transport of larger quantities of milk via freeway routes indicates that at least as low a rate could prevail for additional shipments to Los Angeles. Land prices are reported to be $1,000 to $1,500 per acre, which compare favorably to the San Joaquin Valley.

The San Jacinto-Hemet area lies southeast of Riverside, about 90 miles from Los Angeles. Currently, nine dairies are shipping milk to Los Angeles plants, at a charge of $.26 per hundredweight. There are possibly 25 square miles of

land suitable for dairies in terms of physical and climatic conditions. Present water supplies are adequate, and additional water is expected from the Metropolitan Water District. Year-round production of irrigated forage crops now prevails in the area; some green-chopped alfalfa is being marketed in the Los Angeles district. Current land values are $1,500 to $2,500 per acre.

A third possible area for dairy location lies between Perris and Temecula, in western Riverside County. Farm land primarily produces dry-land grain. Though present water supplies are inadequate for large-scale dairying, additional water from the Metropolitan Water District could permit location on as much as 60 to 70 square miles. Much of Highway 395 is now freeway, offering the possibility of fast, efficient transport to Los Angeles at rates that should be comparable to those from San Jacinto. Land values, now $500 to $1,000 per acre, can be expected to rise if water supplies are increased. No significant competition for land and water resources from urban and industrial uses is anticipated in this, or any other of the outlying areas.

When compared to the Chino Valley, the outlying areas should permit production expansion at about equal combined production and transport costs. Somewhat lower land costs in these areas tend to be offset by higher feed costs and added costs of transporting the product to Los Angeles plants. Hence, it may be concluded that the supply price required to induce expansion of output in these areas to meet increased market needs will be higher in the long-run than is necessary in the northern milkshed.

Implications for Shifts in Market Supply Sources

Great potential thus exists for increasing production in the southern area of the milkshed if Los Angeles and Orange county producers relocate in other districts of San Bernardino and Riverside

counties. This analysis assumes that the producer's demand conditions are unchanged when he relocates within the southern milkshed. Hence, the locational choices of the firm may be treated in a cost-substitution framework, and the location problem is resolved into a search for the least-cost location.

At the same time, a great potential for increased production exists in the San Joaquin Valley either through expansion in output of existing units, which can be accomplished with economies in cost per unit of output, or by increasing the number of dairies. Thus, the relevant question with respect to the requirements of the Los Angeles market for fluid milk in 1980 is one of alternative sources.

Existing regional price differentials imply that resources used in milk production in the northern milkshed will earn a lower return than equivalent resources in the southern milkshed, since factor payments depend on prices received as well as on productivity. Thus, producers in the northern milkshed find themselves handicapped in bidding for productive resources against alternative enterprises, leading to spatial imperfections in the allocation of resources to milk production.

The differential advantage in the southern milkshed is rapidly being capitalized into the value of cows, a phenomenon known as the sale of "shipping rights." Originally, this practice began in connection with the transfer of base within producer cooperatives. In recent years it has spread to producers shipping to regional and local distributors, and reached a point where prices exceeding $1,000 per cow were reported for sale of herds involving the transfer of a contract. Recently, action has been taken by distributors and producer groups to reduce the value of these "rights." The value of comparable animals bought for replacement ordinarily does not exceed $300. The attachment of prices to "shipping rights" is based on the economic concept whereby any asset, intangible as well as tangible, is valued by discounting the future stream of net revenues that can be derived from it—the same valuation mechanism that capitalizes cotton and tobacco allotments into the value of southern farms and irrigation water rights into California farm land values. Therefore, differential contracts benefit producers in the southern milkshed through higher net returns and value appreciation of plant and herd resulting from capitalization of the higher returns anticipated if and when they dispose of their herds. Over a period of time, though, as herds are bought and sold, producers will not benefit from the differential contracts—they will have paid a price for their herd that includes its capitalized value. Further, they will be dependent on a continuation of the contracts to sustain normal profits on their operation. In terms of interregional competition, anything that raises capital requirements for entry into the southern milkshed threatens future generations of producers in that region with a legacy of heavy fixed costs, and reduces any comparative advantages in location, climate, etc., that the region may have over the northern milkshed. Ultimately, the differential returns may be completely dissipated. The resulting inflated cost structure will place the producers at a greater disadvantage in terms of relative production costs in the competing area, and make them dependent on the differential contracts for their existence.

ADJUSTING REGIONAL PRICE DIFFERENTIALS

Efforts to stabilize the California market milk industry in recent decades have included much public intervention in the pricing system, including direct price-fixing at producer and resale levels. The impact of this intervention on market performance in the industry is of paramount interest. Though the purpose of this study is not to propose sweeping

changes in the pricing program to solve economic problems and conflicts in the industry, the critical role of the administered pricing structure in market supply adustments places the ends and means of the pricing system properly within this study's purview.

The legislation establishing the California milk control program had several objectives. Among them were higher returns to producers, stabilization of the pricing system and industry structure, and "fair and reasonable prices" to consumers. Two additional objectives were equity, both in terms of uniformity of raw-product costs to distributors and uniformity of returns to producers; and growth in industry output—to ensure the production and maintenance of an "adequate" supply of milk.

The means used under the control program often achieve several of these objectives simultaneously. For example, the classified pricing system and control of unfair and destructive trade practices—such as improper testing or accounting for milk purchased from producers—not only directly support stabilization but also promote industry efficiency and growth. Efficiency may be increased by providing orderly and economical means of disposing of milk produced but not required for fluid purposes or for any other purpose having mandatory quality requirements. Similarly, the growth objective may be furthered by removal of the frequent and extreme price fluctuations that, under the classical supply-demand model, accompany the alternate shortages and surpluses that usually characterize fluid milk markets. Greater price certainty would encourage production expansion by establishing an economic climate more favorable for production planning in an industry requiring large-scale, long-term investments.

In other cases, certain means, methods, or techniques may further one or more objectives while working against others. For instance, procedures facilitating the best use of resources currently committed to the industry may not be consistent with the objective of promoting the most efficient long-term growth in industry output.

Current industry procurement and use patterns were judged to be acceptably efficient in the first sense. Although aggregate transport costs are higher than their theoretical minimum, because milk shipments do not always originate from producers closest to Los Angeles, no serious departures from efficient organization for existing production units were found.

The situation with respect to the equity objective, however, is somewhat different. Under current application of the control legislation, blend prices are based on the use patterns of individual plants. Distributors pay producers uniformly with respect to surplus use only if their milk is physically commingled—which implies that the milk is received at the same plant. Since Valley country plants and cooperative plants as a group have a proportion of Class 1 use consistently lower than that obtained by Los Angeles plants as a group, the argument is that, on equity grounds, producers in the northern milkshed bear a share of the burden of the surplus that is disproportionate in comparison with producers in the southern milkshed who ship directly to city plants.

Equity arguments are admittedly subjective, and frequently outside the province of economic analysis. Since they involve here the problem of distribution of income, it may be suggested that equity in the present case would imply treating each producer "fairly," i.e., permitting each the same proportion of Class 1 use. Others may argue that equity is achieved when each producer is paid surplus prices when in fact his milk is used for manufacturing. While it is true that economic analysis cannot resolve pure equity questions, it can be directly relevant when other objectives, such as efficiency and growth, are integral parts of

the question of equity. This appears to be true in the present case.

Lower returns in the northern milk-shed, the low-cost producing region, reduce the ability of producers to compete for resources against alternative uses and to expand production. Capitalization of the higher returns in the southern milk-shed increases capital requirements and inflates the structure of production costs in the region, raising the supply price in the long-run for additional output. Both of these factors are inconsistent with efficient growth of industry output. Alternative approaches could be followed in eliminating regional price differentials that do not reflect transport costs. Each of these must be evaluated not only in equity terms but also in terms of its implication for efficient industry growth.

Increasing Producer Returns for Surplus Use

One technique for bringing interregional differentials in net producer prices more in line with transport costs, is to increase returns to producers for market milk going into manfacturing uses. Since the proportion of milk used for these purposes is larger in the northern milkshed, increased returns for surplus use would tend to reduce the current differential in net producer prices.

One way to raise net prices to northern producers is to increase minimum class prices for surplus use. As noted above, this policy was implemented in 1959 by increasing minimum prices for Class 2 use over those for Class 3 use in all San Joaquin Valley areas. Since manufacturing-grade milk can be used for all Class 2 products, the effectiveness of the procedure will depend on the extent to which distributors continue to receive the same amount of milk in excess of their needs for Class 1 use and necessary reserves. If distributors decrease the amount of market milk they are willing to receive when there is no possibility that it will find a Class 1 use, then fewer pro-

ducers or smaller shipments per producer will be required to supply their plants. The Class 2 price increase in 1959 did result in the cancellation of some contracts; one plant dropped 22 producers.

This result of increasing surplus-class prices raises another equity problem. The increased class prices will benefit only the producers who are able to retain their market milk outlet; hence, increased net prices to some producers may be gained largely at the expense of other producers who lose their fluid market and are forced to sell their milk directly for manufacturing. A further consideration is the uncertain economic justification of differential pricing of milk that can be legally used for the same purposes. The latter poses the problem of non-uniformity of raw-product costs to buyers, since market milk purchased for manufacturing of Class 2 products would have to be paid for at substantially higher prices than manufacturing milk used for the same products.

A second method of increasing relative returns to northern producers is to reclassify some of the products that Grade B milk can now be used in making to require use of Grade A milk. The production of cottage cheese and ice cream are good examples, since a large proportion of surplus Grade A skim milk and milk fat in the northern milkshed go into these products. By reclassifying cottage cheese and ice cream so that Grade A milk is required, a larger proportion of milk produced in the area would be paid for at higher class prices, and net prices would increase accordingly. Of course it is implied that the retail prices of the reclassified products will increase to compensate distributors for higher raw-product costs.

Since Class 2 and Class 3 products are more concentrated and less perishable than milk, distributors could bring in the products from out-of-state sources more cheaply than by using local Grade A supplies. For instance, it may be possi-

ble for desiccated curd or ice cream mix to be processed from surplus Grade A milk and shipped from Arizona, Utah, or Idaho at a lower at-market cost than from processing the same products in the northern milkshed with Class 1 milk.

A related problem is the influence of increased prices of the products concerned on per capita consumption. Since the dairy industry is interested in increased consumption of its products, this procedure may not be desirable, especially because products such as ice cream and cottage cheese are thought to have a greater elasticity of demand with respect to price than do fluid milk or cream.

Even the concept of higher prices, in view of current production levels, may be questioned. Though the industry model indicates the "efficient" differential in regional prices, it also implies an equilibrium price level that would clear the market. Therefore, an approximation to equilibrium price levels in the present case would be unlikely to imply higher prices at any point in the supply area. Rather, it would more likely imply lower prices in both regions, but a larger relative decline in prices in the deficit area to bring the regional differential into line with transport costs.

Market-wide Pooling

A second technique for reducing regional price differentials is market-wide pooling to redistribute the benefits of Class 1 as compared to surplus use. The important feature of this type of pooling is that each producer is paid a blend price based on the proportion of Class 1 use in the entire market, which tends to distribute the benefits of class pricing equally over all producers participating in the pool. It is not necessary, however, that all price differentials disappear, since net prices could be adjusted to reflect differences in milk fat content and transport costs. This is the situation that

many observers suggest would fulfill completely the equity objective.

The most important problems with respect to the efficiency and growth objectives involve the impact of market-wide pooling on the effectiveness of prices in guiding producer and distributor decisions about production and use. The present contract-pooling transmits to the individual producer the effect of increased production over Class 1 needs, because of the rapid decline in net prices received for surplus production. Under market-wide pooling, blend prices depend on production and use in the entire market; hence, no individual producer is likely to recognize any interdependence between his total production and net price received. Of course, the present contract system, in the form of a base-surplus plan, could be adapted for market-wide pooling, to retain controls on excess production. However, a uniform policy would have to be established with respect to entry of new producers, overbase shipments, and base increases, rather than leaving their determination to individual distributors.

A related problem involves maintaining efficient use patterns in the milkshed. Since blend prices paid to producers by individual plants would no longer depend on the use pattern of the particular plant, plant managers would be under no competitive pressures to obtain sufficient Class 1 use to enable the plant to pay prices comparable to those being paid by other plants obtaining supplies from the same producing district. Therefore, the supply of milk for the plant would not depend directly on blend prices that reflect the plant's disposition of its receipts. The net result is very likely to be the use of more milk from the southern milkshed in manufactured products, increased shipments of milk from the northern milkshed, and higher transport costs for the market as a whole. In turn the aggregate net value of the raw product is

lowered, even though it is distributed "equitably" over all producers.

Modifying Distributors' Procurement Policies and Practices

The third—and perhaps simplest—general technique for bringing interregional differentials in net producer prices more in line with transport costs is to modify market supply patterns so that a greater proportion of Class 1 use of Los Angeles plants is supplied by producers in the northern milkshed. To maintain efficient use patterns, this method would involve either an absolute decrease in receipts or a decreasing share of total supply from southern producers. The latter implies that supplies to meet increasing market requirements would be obtained largely from northern producers. Available data do not support the supposition that the northern milkshed has been supplying a growing relative share of market requirements since the Korean War. In fact, there is more reason to believe that the reverse is true. Hence, the possibility arises of influencing distributors' procurement policies and practices within the existing institutional framework.

At the most mechanical level, regulations could be imposed that establish minimum Class 1 guarantees for producers' contracts. For instance, lower limits of 75 per cent milk fat and 50 per cent skim milk could be imposed in the northern milkshed. But, as long as contract bases are determined through bilateral bargaining between a distributor and each producer, a distributor could maintain the same aggregate Class 1 guarantee by merely adusting contract bases downward. This is to say, as long as the pooling system is unchanged and the Class 1 use of the plant remains the same, then restrictions on contract provisions can have no real impact on average net returns to producers in a given area.

A more promising area for influencing procurement patterns involves country plants. Important aspects of distributors' policies on country-plant producers include: a historical willingness to accept new producers rather than obtain increased requirements from existing producers; base and Class 1 guarantee reductions for under-quota production; and implicit requirements for overbase production to qualify for base increases. In view of the interest of these distributors in maintaining adequate supplies of milk not only for Class 1 use but also for Class 2 purposes, these policies seem perfectly rational—especially in light of decreasing Grade B production. At the same time, enormous vested interests in the present market supply patterns have accumulated in the southern milkshed.

The fact that supplies at some country plants now exceed not only Class 1 requirements but also Class 2 needs has led some distributors to discourage overbase shipments to country plants, and to eliminate contract penalties for underbase production. However, this does not mean a reversal of the historical role of country plants in market supply patterns; lower levels of surplus production in the future would very likely lead to a return to past policies.

An organizational change in the market structure that would contribute to breaking down historical supply patterns is direct shipments from northern producers to Los Angeles plants, as is done in the case of shipments to plants in the San Francisco Bay Area. Because of the higher proportion of Class 1 use, such shipments would increase net returns to producers, even though transport charges to Los Angeles were deducted from total production. In addition, the country-plant handling charge would be eliminated.

The impact of direct shipments on the efficiency of market use depends on the degree to which they are limited to milk required for Class 1 purposes. Shipments

in excess, which must be diverted to manufacturing at Los Angeles plants or back-hauled to northern plants, would raise aggregate transport costs in the market, and reduce the net value of the raw product below its theoretical maximum.

Several factors prevent adoption of this practice. First, firms with country plants are unlikely to permit direct shipments as long as they are permitted, legally and by the competitive situation in the buying market, to deduct a handling charge for reshipment of milk and cream from northern plants. At the same time, shipments from the northern milkshed would be increased only if the charge is high enough to encourage distributors to increase their use of milk from the northern milkshed in order to secure lower raw-product costs. In addition, direct shipments would create serious competitive difficulties between producers shipping direct and those required to ship to a country plant. The necessary costs of maintaining country plants to handle surpluses might fall completely on producers not shipping direct. Finally, strong vested interests, as represented by the bargaining cooperative serving as the sole direct supplier for the Los Angeles plant of a regional distributor, would increase the reluctance of distributors to alter current procurement practices.

The most effective method of influencing distributors' procurement practices would be to provide some economic incentive for them to obtain increased supplies of milk for Class 1 use from the northern milkshed. Minimum pricing, f.o.b. the plant, has made it impossible for northern producers to turn their more favorable production cost structures into a competitive advantage in the raw-product market. Hence, procurement patterns largely reflect historical supply relationships that are deeply imbedded in the organization of the market and have resulted in the current distortion in interregional price differentials.

If future requirements are such that production will be sufficient only to meet Class 1 needs and necessary operating reserves, it seems highly likely that current policies of regional distributors will be altered. The interim need is for changes in the institutional pricing structure that will generate incentives for expansion of production in low-cost areas, with no additional expansion, if not absolute decline, in the high-cost areas. This would tend to restore the function of the pricing system in guiding adjustments in allocation of resources based on fundamental cost advantages in the competing supply regions.

A recent development in the pricing program may also affect the competitive position of producers in the northern milkshed. The Bureau of Milk Stabilization recently advanced the opinion that cooperatives, as well as proprietary distributors, must return full minimum class prices to their members. Although these prices have applied in the past to the sale of milk by cooperatives to other distributors, the new ruling implies sale at above-minimum prices. At present, no action has been taken to enforce this opinion. Were action to be taken, this major avenue of access to Class 1 use by Los Angeles plants might be jeopardized, since the distributors involved might very well attempt to induce producers in the southern milkshed to supply their full needs in order to maintain current raw-product costs.

APPENDIX A

Table A-1. Commercial Market Milk Fat Production, 1946–1959

Year	Los Angeles County	Orange County	San Bernardino County	Riverside County	Total southern milkshed	San Joaquin Valley
	thousand pounds					
1946.........................	37,941	4,828	5,700	2,104	50,573	31,962
1947.........................	39,657	5,703	6,412	1,994	53,765	34,525
1948.........................	39,720	5,671	5,845	1,737	52,973	34,612
1949.........................	39,992	6,082	5,833	1,555	53,462	36,341
1950.........................	40,163	6,880	6,080	1,730	54,853	38,784
1951.........................	41,793	8,786	6,660	1,870	59,109	40,509
1952.........................	42,709	9,089	6,559	2,312	60,669	41,053
1953.........................	45,158	9,825	7,032	2,837	64,852	45,951
1954.........................	45,179	10,770	7,856	2,993	66,798	50,396
1955.........................	45,569	11,574	9,504	3,206	69,853	53,447
1956.........................	46,839	11,953	11,566	3,728	74,086	59,457
1957.........................	48,077	12,678	13,341	5,145	79,241	69,761
1958.........................	45,812	13,711	14,908	6,205	80,636	72,299
1959.........................	45,385	14,354	16,707	7,185	83,631	79,298

SOURCES: California Crop and Livestock Reporting Service (A 1946–58 and B 1959).

APPENDIX B

Table B-1. Costs of Production for 30-Stanchion Barn and Varying Herd Sizes, by Region

Cost item	Herd size—Southern milkshed				Herd size—Northern milkshed			
	30	60	90	120	30	60	90	120
	dollars							
Fixed costs............	8,522.10	8,522.10	8,522.10	8,522.10	4,795.70	4,795.70	4,795.70	4,795.70
Variable costs								
Feed...............	9,246.80	18,493.65	27,740.50	36,987.30	7,145.05	14,290.15	21,435.20	28,580.30
Labor..............	2,876.20	5,544.35	7,391.25	10,347.75	2,554.80	4,963.60	6,569.50	9,418.25
Replacements.......	1,350.00	2,700.00	4,050.00	5,400.00	1,350.00	2,700.00	4,050.00	5,400.00
Other..............	960.00	1,920.00	2,880.00	3,840.00	750.00	1,500.00	2,250.00	3,000.00
Total costs......	22,955.10	37,180.10	50,583.85	65,097.15	16,595.55	28,249.45	39,100.40	51,194.25
Production (lbs. milk)	410,970	821,940	1,232,910	1,643,880	386,220	772,440	1,158,660	1,544,880
Unit cost ($/cwt.).....	5.59	4.52	4.10	3.96	4.30	3.66	3.37	3.31

Table B-2. Costs of Production for 60-Stanchion Barn and Varying Herd Sizes, by Region

Cost item	Herd size—Southern milkshed				Herd size—Northern milkshed			
	60	120	180	240	60	120	180	240
	dollars							
Fixed costs............	14,304.00	14,304.00	14,304.00	14,304.00	6,953.70	6,953.70	6,953.70	6,953.70
Variable costs								
Feed...............	18,493.65	36,987.30	55,480.95	73,974.60	14,290.15	28,580.30	42,870.40	57,160.55
Labor..............	7,475.20	11,826.00	16,180.45	20,943.70	6,644.50	10,511.20	14,381.90	18,615.60
Replacements.......	2,700.00	5,400.00	8,100.00	10,800.00	2,700.00	5,400.00	8,100.00	10,800.00
Other..............	1,920.00	3,840.00	5,760.00	7,680.00	1,500.00	3,000.00	4,500.00	6,000.00
Total costs......	44,892.85	72,357.30	99,825.40	127,702.30	32,088.35	54,445.20	76,806.00	99,529.85
Production (lbs. milk)	821,940	1,643,880	2,465,820	3,287,760	772,440	1,544,880	2,317,320	3,089,760
Unit cost ($/cwt.).....	5.46	4.40	4.05	3.88	4.15	3.52	3.31	3.22

Table B-3. Costs of Production for 90-Stanchion Barn and Varying Herd Sizes, by Region

Cost item	Herd size—Southern milkshed				Herd size—Northern milkshed			
	90	180	270	360	90	180	270	360
	dollars							
Fixed costs............	19,685.70	19,685.70	19,685.70	19,685.70	9,061.70	9,061.70	9,061.70	9,061.70
Variable costs								
Feed...............	27,740.50	55,480.95	83,221.40	110,961.90	21,435.20	42,870.40	64,305.65	85,740.80
Labor..............	10,347.75	17,903.25	25,294.50	32,796.70	9,197.30	15,912.80	22,482.30	29,126.80
Replacements.......	4,050.00	8,100.00	12,150.00	16,200.00	4,050.00	8,100.00	12,150.00	16,200.00
Other..............	2,880.00	5,760.00	8,640.00	11,520.00	2,250.00	4,500.00	6,750.00	9,000.00
Total costs..........	64,703.95	106,929.90	148,991.60	191,164.30	45,994.20	80,449.90	114,748.65	149,129.35
Production (lbs. milk)	1,232,910	2,465,820	3,698,730	4,931,640	1,158,660	2,317,320	3,475,980	4,634,640
Unit cost ($/cwt.).....	5.25	4.34	4.03	3.88	3.97	3.47	3.30	3.22

Cost item	Herd size—Southern milkshed				Herd size—Northern milkshed			
	120	240	360	480	120	240	360	480
	dollars							
Fixed costs............	23,235.35	23,235.35	23,235.35	23,235.35	11,023.10	11,023.10	11,023.10	11,023.10
Variable costs								
Feed................	36,987.30	73,974.60	110,961.90	150,587.20	28,580.30	57,160.55	87,740.85	114,321.10
Labor..............	13,388.20	23,816.25	34,083.70	44,347.50	11,900.10	21,168.40	30,294.70	39,417.05
Replacements.......	5,400.00	10,800.00	16,200.00	21,600.00	5,400.00	10,800.00	16,200.00	21,600.00
Other..............	3,840.00	7,680.00	11,520.00	15,360.00	3,000.00	6,000.00	9,000.00	12,000.00
Total costs......	82,850.85	139,506.20	196,000.95	255,130.05	59,903.50	106,152.05	154,258.65	198,091.25
Production (lbs. milk)	1,643,880	3,287,760	4,931,640	6,575,520	1,544,880	3,089,760	4,634,640	6,179,520
Unit cost ($/cwt.).....	5.04	4.24	3.98	3.87	3.88	3.44	3.33	3.21

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